North Corridor Transit Partners
PARAMETRIX + PARSONS BRINCKERHOFF

SOUNDTRANSIT

North Corridor Transit Project

Alternatives Analysis Report

and SEPA Addendum

SEPTEMBER 2011

This study was funded in part by the U.S. Department of Transportation, Federal Transit Administration through a grant from the Section 5339 Alternatives Analysis program, and by a Surface Transportation Program grant through the Puget Sound Regional Council. Sound Transit gratefully acknowledges the support of these agencies.

This Alternative Analysis report also serves as an addendum to Sound Transit's Supplemental EIS on the Regional Transit Long-Range Plan (Sound Transit 2005b). It adds information and analysis regarding the North Corridor transit alternatives and their environmental impacts. This addendum is issued pursuant to the State Environmental Policy Act (SEPA) rules, WAC 197-11-600(4)(c) and WAC 197-11-625.

TABLE OF CONTENTS

SUMMARY S-1

S.1 Introduction S-1
S.2 North Corridor Purpose and Need S-4
S.3 Development, Screening, and Evaluation of Alternatives S-7
S.4 Early Public and Agency Involvement S-9
S.5 Concept Development and Screening S-10
S.5.1 Concepts Eliminated in Pre-Screening S-10
S.5.2 Concepts Carried Forward For Development and Screening S-11
S.5.3 Concept Screening S-13
S.6 Level 1 Alternatives Development and Evaluation S-16
S.6.1 Level 1 Alternatives S-16
S.6.2 Level 1 Alternatives Evaluation and Findings S-18
S.7 Level 2 Alternatives S-21
S.7.1 TSM/Baseline Alternative S-21
S.7.2 L1: I-5 Light Rail Alternative S-24
S.7.3 L2: SR 99 Mixed Profile Light Rail Alternative S-26
S.7.4 L3: SR 99 Elevated Light Rail Alternative S-30
S.7.5 B2: Multi-Corridor BRT Alternative S-30
S.8 Level 2 Alternatives Evaluation S-34
S.8.1 Summary Evaluation S-34
S.8.2 Key Findings by Purpose and Need Category S-34
S.8.3 Findings by Alternative S-43
S.9 Trade-offs among the Alternatives S-49
S.10 Next Steps S-51

1 INTRODUCTION 1-1

1.1 Context of the Alternatives Analysis 1-1
1.2 Purpose and Overview of the Alternatives Analysis 1-2
1.3 Relationship to the Environmental Process 1-4
1.4 Organization of the Report 1-5

2 PURPOSE AND NEED 2-1

2.1 Purpose and Need Statement 2-1

2.1.1 The Purpose of the North Corridor Transit Project 2-2

2.1.2 The Need for the Project 2-2

2.2 The North Corridor 2-3

2.3 Planning History 2-4

2.3.1 PSRC High Capacity Transit Corridor Assessment 2-5

2.3.2 Regional Transit Long-Range Plan 2-6

2.3.3 ST2 Plan Development 2-6

2.3.4 Population and Employment in the North Corridor Communities 2-6

2.4 Demographics in the North Corridor Communities 2-7

2.5 Regional Plans for Managing Growth 2-9

2.5.1 VISION 2040 2-9

2.5.2 Transportation 2040 2-9

2.6 Transportation System 2-11

2.6.1 Highway Facilities 2-11

2.6.2 Transit System 2-13

2.6.3 Transit Travel Patterns 2-14

3 DEVELOPMENT AND SCREENING OF ALTERNATIVES 3-1

3.1 Overview 3-1

3.2 Evaluation Process 3-1

3.2.1 Basis in Purpose and Need 3-1

3.2.2 Evaluation Methodology and Criteria 3-4

3.3 Initial Concept Definition 3-7

3.3.1 Early Public and Agency Involvement 3-7

3.3.2 Operating Strategy 3-8

3.3.3 Concepts Eliminated in Pre-Screening 3-10

3.3.4 Initial Concepts Carried Forward for Screening and Development 3-12

3.3.5 TSM/Baseline Concept 3-16

3.3.6 I-5 Light Rail Concept 3-16

3.3.7 SR 99 Light Rail Concept 3-17

3.3.8 15th Avenue NE Light Rail Concept 3-17

3.3.9 I-5 BRT Concept 3-18
3.3.10 Multi-Corridor BRT Concept 3-19
3.4 Initial Concept Screening Results 3-21
3.4.1 15th Avenue NE Light Rail Concepts Screened Out 3-21
3.4.2 SR 99 Fully At-Grade Light Rail Alignment Screened Out 3-25
3.4.3 SR 99 Light Rail Sub-Alternative Alignments Screened Out 3-25
3.5 Level 1 Alternatives Definition 3-26
3.5.1 Elements Common to All Alternatives 3-26
3.5.2 No Build Alternative 3-27
3.5.3 TSM/Baseline Alternative 3-27
3.5.4 L1: I-5 Light Rail Alternative 3-27
3.5.5 L2: SR 99 Light Rail Alternative 3-28
3.5.6 B1: I-5 BRT Alternative 3-28
3.5.7 B2: Multi-Corridor BRT Alternative 3-29
3.6 Level 1 Alternatives Evaluation 3-29
3.6.1 Transportation Effectiveness 3-29
3.6.2 Community Equity 3-38
3.6.3 Land Use and Economic Development 3-39
3.6.4 Environmental Performance 3-40
3.6.5 Effects on Transportation System 3-44
3.6.6 Cost and Constructability 3-46
3.6.7 Consistency with Sound Transit's Long-Range Vision 3-48
3.7 Alternatives Carried Forward into Level 2 Evaluation 3-48
3.7.1 TSM/Baseline Alternative 3-49
3.7.2 L1: I-5 Light Rail Alternative 3-51
3.7.3 L2: SR 99 Light Rail Alternative 3-52
3.7.4 B1: I-5 BRT Alternative 3-54
3.7.5 B2: Multi-Corridor BRT Alternative 3-55
3.7.6 Possible Future Changes to I-5 by WSDOT 3-56
4 DETAILED DEFINITION OF LEVEL 2 ALTERNATIVES 4-1
4.1 No Build Alternative 4-1
4.1.1 Transportation Facilities 4-1

4.1.2 Bus Service Plan 4-2
4.2 TSM/Baseline Alternative 4-2
4.2.1 Facility Design 4-3
4.2.2 Service Plan 4-6
4.3 L1: I-5 Light Rail Alternative 4-7
4.3.1 Facility Design 4-8
4.3.2 Service Plan 4-17
4.4 L2: SR 99 Mixed Profile Light Rail Alternative 4-18
4.4.1 Facility Design 4-21
4.4.2 Alignment Variations 4-29
4.4.3 Service Plan 4-30
4.5 L3: SR 99 Elevated Light Rail Alternative 4-31
4.5.1 Facility Design 4-33
4.5.2 Service Plan 4-40
4.6 B2: Multi-Corridor Bus Rapid Transit Alternative 4-41
4.6.1 Facility Design 4-42
4.6.2 Service Plan 4-48
4.7 Operation and Maintenance Facilities 4-49
5 ANALYSIS OF ALTERNATIVES 5-1
5.1 Transportation Effectiveness 5-1
5.1.1 Key Findings 5-2
5.1.2 Ridership Potential 5-4
5.1.3 Ability to Accommodate Demand 5-13
5.1.4 Travel Time 5-15
5.1.5 Transit Reliability 5-25
5.1.6 System-Wide Vehicle Miles Traveled 5-27
5.1.7 Transit Service Accessibility 5-27
5.2 Land Use and Economic Development Potential 5-35
5.2.1 Key Findings 5-36
5.2.2 Land Use and Economic Development Compatibility 5-37
5.2.3 Transit-Supportive Land Use 5-42
5.3 Environmental Performance 5-53

5.3.1 Key Findings 5-53
5.3.2 Ecosystems 5-56
5.3.3 Water Resources 5-57
5.3.4 Section 4(f) and Section 6(f) Resources 5-60
5.3.5 Historic Resources 5-62
5.3.6 Archaeological Resources 5-64
5.3.7 Air Quality and Greenhouse Gas Emissions 5-65
5.3.8 Aesthetics 5-66
5.3.9 Noise 5-67
5.3.10 Property Acquisitions and Displacements 5-70
5.3.11 Transportation 5-72
5.4 Community Equity 5-83
5.4.1 Construction Effects 5-84
5.4.2 Effects on Environmental Justice Communities 5-85
5.4.3 Transportation Benefits 5-86
5.5 Financial Analysis 5-88
5.5.1 Key Findings 5-88
5.5.2 Capital Costs 5-91
5.5.3 Operating Costs 5-93
5.5.4 Financial Feasibility 5-95
5.5.5 Operating Efficiencies 5-95
5.5.6 Risks and Uncertainties 5-97
5.6 Consistency with Sound Transit's Long-Range Vision 5-99
6 PUBLIC AND AGENCY INVOLVEMENT AND COORDINATION 6-1
6.1 Overview of Plans 6-1
6.1.1 Public Involvement Plan 6-1
6.1.2 Agency Coordination Plan 6-3
6.2 Early Scoping 6-3
6.2.1 Public Notices in the Federal Register and the SEPA Register 6-4
6.2.2 Public Early Scoping 6-6
6.2.3 Agency Early Scoping Meeting 6-7
6.2.4 Opportunities to Comment 6-7

6.3 Summary of Written Comments Received 6-8
6.3.1 Comments Related to the Preliminary Purpose and Need Statement 6-8
6.3.2 Comments Specific to a Mode 6-8
6.3.3 Comments Specific to a Potential Project Alignment or Features 6-9
6.4 Online Questionnaire and Additional Public Outreach 6-10
6.4.1 Online Questionnaire 6-10
6.4.2 Stakeholder Interviews 6-11
6.4.3 Public Outreach to Minority and Low-Income Populations ("Environmental Justice") 6-12
6.4.4 Agency Involvement 6-13
6.4.5 Policy Advisory Committee 6-13
6.4.6 Interagency Technical Working Group 6-13
6.5 SHARING THE RESULTS OF THE ALTERNATIVES ANALYSIS 6-15
7 COMPARATIVE EVALUATION OF ALTERNATIVES 7-1
7.1 Introduction 7-1
7.1.1 Transportation Effectiveness in Meeting Mobility, Access, and Capacity Needs 7-4
7.1.2 Equitable Community Impacts and Benefits 7-7
7.1.3 Supportive Land Use and Economic Development Effects 7-7
7.1.4 Preservation of a Healthy Environment 7-8
7.1.5 Cost and Constructability 7-10
7.1.6 Consistency with Sound Transit's Long-Range Plan Vision 7-11
7.2 Summary Findings 7-12
7.2.1 TSM/Baseline Alternative 7-12
7.2.2 L1: I-5 Light Rail Alternative 7-12
7.2.3 L2: SR 99 Mixed Profile Light Rail Alternative 7-14
7.2.4 L3: SR 99 Elevated Light Rail Alternative 7-17
7.2.5 B2: Multi-Corridor BRT Alternative 7-19
8 CONCLUSIONS AND NEXT STEPS 8-1
8.1 Conclusions and Trade-Offs Among the Alternatives 8-1
8.2 Environmental Process and SAFETEA-LU Requirements 8-4
8.3 Next Steps 8-4
9 References 9-1

LIST OF TABLES

Table S-1. Level 2 Alternatives Evaluation Summary S-36, S-37
Table 3-1. Initial Concept Development Review Screening Criteria and Measures 3-5
Table 3-2. Levels 1 and 2 Evaluation Criteria and Measures 3-6, 3-7
Table 3-3. Estimated Existing Daily Transit Trip Pairs from the North Corridor to Various Districts 3-9
Table 3-4. Initial Concept Review and Screening Summary 3-22
Table 3-5. Recommended Level 1 Alternatives 3-23
Table 3-6. 2030 Transit Ridership Forecasting Model Output Summary 3-34
Table 3-7. Practical Person-Carrying Capacity 3-35
Table 3-8. 2030 Transit Peak-Period, Peak-Direction Travel Times (minutes) from Lynnwood to Regional Growth Centers 3-35
Table 3-9. 2030 Transit Peak-Period, Off-Peak Direction Travel Times (minutes) from Lynnwood to Regional Growth Centers 3-36
Table 3-10. 2030 Transit Peak-Period, Peak-Direction Travel Times (minutes) from Shoreline to Regional Growth Centers 3-36
Table 3-11. 2030 Transit Peak-Period, Off-Peak Direction Travel Times (minutes) from Shoreline to Regional Growth Centers 3-36
Table 3-12. Miles of Operation on Non-Exclusive Guideway 3-37
Table 3-13. Number of At-Grade Signalized Intersections Traversed 3-38
Table 3-14. Year 2000 Low-Income and Minority Populations within 0.5 Mile of Alignments 3-38
Table 3-15. Year 2000 Low-Income and Minority Populations within 0.5 Mile of Station Areas. 3-39
Table 3-16. Summary of Land Use and Economic Development Measures by Alternative 3-40
Table 3-17. Summary of Environmental Performance 3-41
Table 3-18. Summary of Transportation Effects 3-44
Table 3-19. Cost Ranges for Level 1 Alternatives 3-46
Table 3-20. 2030 Operation and Maintenance Cost Estimates 3-47
Table 3-21. Level 1 Evaluation Results—Consistency with Long-Range Plans 3-48
Table 3-22. Level 1 Alternatives Evaluation Summary 3-50
Table 5-1. Transit Ridership Forecasting Model Output Summary for 2030 5-6
Table 5-2. 2030 Change in Daily Transit Trips to/from Selected Regional Growth Centers 5-13
Table 5-3. 2030 Maximum Person-Carrying Capacity 5-15

Table 5-4. Estimated 2030 Transit Peak Period, Peak Direction, Travel Times (minutes) from Lynnwood to Selected Regional Growth Centers 5-18
Table 5-5. Estimated 2030 Transit Peak Period, Off-Peak Direction, Travel Times (minutes) from Lynnwood to Selected Regional Growth Centers 5-18
Table 5-6. Estimated 2030 Transit Peak Period, Peak Direction, Travel Times (minutes) from Shoreline to Selected Regional Growth Centers 5-19
Table 5-7. Estimated 2030 Transit Peak Period, Off-Peak Direction, Travel Times (minutes) from Shoreline to Selected Regional Growth Centers 5-19
Table 5-8. Miles of Operation on Non-Exclusive Guideway 5-25
Table 5-9. Number of At-Grade Signalized Intersections Traversed and Congestion 5-26
Table 5-10. Year 2030 Highway Performance Measures 5-27
Table 5-11. Service Accessibility 5-29
Table 5-12. Summary of Consistency with PSRC VISION 2040 and Regional Economic Strategy 5-37
Table 5-13. Summary of Land Use Compatibility by Alternative 5-39
Table 5-14. General Existing Land Use by Alternative 5-39
Table 5-15. Existing and Forecasted Station Area Population, Employment, and Housing 5-42
Table 5-16. Summary of Balanced Mix of Uses by Alternative 5-44
Table 5-17. Summary of Existing Station Area Character for Alternatives 5-45
Table 5-18. Existing Station Area Character Rating 5-46
Table 5-19. Summary of Connectivity to Activity Centers within Station Areas for Alternatives 5-47
Table 5-20. Walk Rating by Activity Center 5-48
Table 5-21. Transit-Supportive Plans and Policies by Alternative 5-50
Table 5-22. Transit-Supportive Plans and Policies by Stations 5-51
Table 5-23. Sections 4(f) and 6(f) Properties within 0.25 Mile of the Four Build Alternative Alignments 5-61
Table 5-24. Summary of Right-of-Way Needs and Affected Property Types 5-71
Table 5-25. Level 2 Evaluation Results—General Purpose Traffic Operations 5-73
Table 5-26. Level 2 Evaluation Results—Transit Operations 5-77
Table 5-27. Level 2 Evaluation Results—Safety 5-80
Table 5-28. Capital Cost Ranges for Level 2 Alternatives 5-93
Table 5-29. Operation and Maintenance Cost Estimates 5-94

Table 5-30. Level 2 Alternative Capital Cost Affordability 5-95
Table 5-31. 2030 Annual O&M Cost per Annual Passenger Mile 5-96
Table 5-32. 2030 Cost per Hour of User Benefits 5-96
Table 5-33. 2030 Incremental Cost per New Passenger 5-97
Table 5-34. Evaluation Results—Consistency with Long-Range Plan 5-101
Table 7-1. Level 2 Alternatives Evaluation Summary 7-2, 7-3

LIST OF FIGURES

Figure S-1. Sound Transit 2 Regional Transit System Plan Map and North Corridor S-3
Figure S-2. North Corridor Project Area and Relation to Link Light Rail System S-5
Figure S-3. Alternatives Analysis Evaluation Framework S-7
Figure S-4. Relationship of Purpose and Need to Evaluation Categories and Criteria S-8
Figure S-5. Light Rail Concepts S-12
Figure S-6. BRT Concepts S-12
Figure S-7. TSM/Baseline Alternative S-23
Figure S-8. L1: I-5 Light Rail Alternative S-25
Figure S-9. L2: SR 99 Mixed Profile Light Rail Alternative S-27
Figure S-10. 4- and 8-Minute System Operating Plans S-29
Figure S-11. L3: SR 99 Elevated Light Rail Alternative S-31
Figure S-12. B2: Level 2 Multi-Corridor BRT Alternative S-33
Figure S-13. Year 2030 Auto and Transit AM Peak Hour Travel Times S-38
Figure S-14. Summary of Alternatives Development, Screening, and Evaluation Process S-50
Figure 1-1. Sound Transit 2 Regional Transit System Plan Map and North Corridor 1-3
Figure 2-1. North Corridor Project Area and Relation to Link Light Rail System 2-5
Figure 2-2. 2010 and 2030 Population Density Forecasts – North Corridor 2-8
Figure 2-3. 2010 and 2030 Employment Density Forecasts – North Corridor 2-8
Figure 2-4. VISION 2040 Regional Centers 2-10
Figure 2-5. Travel-Time Reliability for the Everett-to-Seattle Commute via I-5 2-12
Figure 2-6. Distribution of 2010 Daily Transit Trips to/from North Corridor 2-15
Figure 2-7. Existing Daily Transit Ridership for the North Corridor 2-16
Figure 3-1. Alternatives Analysis Evaluation Framework 3-2

Figure 3-2. Conceptual Operating Strategy for North Corridor Transit Concepts 3-11
Figure 3-3. TSM/Baseline Concept 3-13
Figure 3-4. Light Rail Concepts 3-14
Figure 3-5. BRT Concepts 3-15
Figure 3-6. L1: Level 1 I-5 Light Rail Alternative 3-30
Figure 3-7. L2: Level 1 SR 99 Light Rail Alternative 3-31
Figure 3-8. B1: Level 1 I-5 BRT Alternative 3-32
Figure 3-9. B2: Level 1 Multi-Corridor BRT Alternative 3-33
Figure 4-1. Level 2 TSM/Baseline Alternative 4-4
Figure 4-2. Northgate Area Transit Queue Bypass Improvement 4-5
Figure 4-3. Level 2 L1: I-5 Light Rail Alternative 4-11
Figure 4-4. Level 2 L1: I-5 Light Rail Alternative Detail – 1 of 4 4-12
Figure 4-5. Level 2 L1: I-5 Light Rail Alternative Detail – 2 of 4 4-13
Figure 4-6. Level 2 L1: I-5 Light Rail Alternative Detail – 3 of 4 4-14
Figure 4-7. Level 2 L1: I-5 Light Rail Alternative Detail – 4 of 4 4-15
Figure 4-8. L1: I-5 Light Rail Alternative – Typical Cross-section of Elevated Rail on East Side of Roadway 4-16
Figure 4-9. L1: I-5 Light Rail Alternative – Typical Cross-section of At-grade Rail on East Side of Roadway 4-16
Figure 4-10. L1: I-5 Light Rail Alternative – Typical Cross-section of At-grade Rail in Median of Roadway 4-16
Figure 4-11. 4-and 8-Minute System Operating Plans 4-21
Figure 4-12. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative 4-22
Figure 4-13. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail – 1 of 4 4-23
Figure 4-14. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail – 2 of 4 4-24
Figure 4-15. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail – 3 of 4 4-25
Figure 4-16. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail – 4 of 4 4-26
Figure 4-17. Existing SR 99 Typical Cross-section 4-27
Figure 4-18. L2: SR 99 Mixed Profile Light Rail Alternative Typical At-grade Mid-block Cross section 4-27
Figure 4-19. L2: SR 99 Mixed Profile Light Rail Alternative At-grade Cross-section at Intersection with Station 4-27
Figure 4-20. L3: Level 2 SR 99 Elevated Light Rail Alternative 4-32

Figure 4-21. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail – 1 of 4 4-34
Figure 4-22. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail – 2 of 4 4-35
Figure 4-23. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail – 3 of 4 4-36
Figure 4-24. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail – 4 of 4 4-37
Figure 4-25. Existing SR 99 Typical Cross-section 4-38
Figure 4-26. L3: SR 99 Elevated Light Rail Alternative Typical Cross section 4-38
Figure 4-27. B2: Level 2 Multi-Corridor BRT Alternative 4-43
Figure 4-28. Direct Access Improvements and Northgate BRT Station – 1 of 2 4-46
Figure 4-29. Direct Access Improvements and Northgate BRT Station – 2 of 2 4-47
Figure 5-1. 2030 Total System Daily Transit Trips and Percent Change for Alternatives Compared to No Build 5-6
Figure 5-2. 2030 Daily Transit Ridership – TSM/Baseline 5-7
Figure 5-3. 2030 Daily Transit Ridership – L1: I-5 Light Rail 5-8
Figure 5-4. 2030 Daily Transit Ridership – L2: SR 99 Mixed Profile Light Rail 5-9
Figure 5-5. 2030 Daily Transit Ridership – L2: SR 99 North Variation 5-10
Figure 5-6. 2030 Daily Ridership – L3: SR 99 Elevated Light Rail 5-11
Figure 5-7. 2030 Daily Transit Ridership – B2: Multi-Corridor BRT 5-12
Figure 5-8. Estimated 2030 Travel Times from Lynnwood to Northgate 5-16
Figure 5-9. Estimated 2030 Travel Times from Shoreline to Northgate 5-17
Figure 5-10. 2030 Transit Peak Period Travel Times from Lynnwood to University District 5-20
Figure 5-11. 2030 Transit Peak Period Travel Times from Lynnwood to Downtown Seattle 5-21
Figure 5-12. 2030 Peak Period, Peak Direction, Travel Times from Lynnwood to Northgate University District – Transit vs. Automobile 5-23
Figure 5-13. 2030 Peak Period, Peak Direction, Travel Times from Lynnwood to Downtown Seattle and SeaTac Airport – Transit vs. Automobile 5-24
Figure 5-14. 15-Minute Pedestrian and Bicycle Travel Sheds at the SR 99/130th Street, SR 99/160th Street, Shoreline Park-and-Ride and SR 99/220th Street Stations 5-31
Figure 5-15. 15-Minute Pedestrian and Bicycle Travel Sheds at the I-5/145th Street, I-5/185th Street, Mountlake Terrace and Lynnwood Transit Center Stations 5-32
Figure 5-16. 15-Minute Pedestrian and Bicycle Travel Sheds at 15th Avenue NE, NE 145th Street/ 15th Avenue NE, NE 175th Street/15th Avenue NE and Ballinger Way/19th Avenue NE Stations 5-33
Figure 5-17. 15-Minute Pedestrian and Bicycle Travel Sheds at North 175th Street/Meridian Avenue North and Edmonds Park-and-Ride Stations 5-34

Figure 5-18. General Existing Land Uses 5-40
Figure 5-19. Zoned Mix of Uses by Station Area 5-44
Figure 5-20. Activity Centers 5-49
Figure 5-21. Ecosystems 5-59
Figure 5-22. Parks and Recreation Facilities in the Project Area 5-63
Figure 5-23. Screenline V/C Ratios at King/Snohomish County Line 5-74
Figure 5-24. Intersections Worsened by Level 2 Alternatives – PM Peak Hour 5-75
Figure 5-25. Construction Effects on Transportation System 5-82
Figure 5-26. Environmental Justice Communities 5-90
Figure 8-1. Summary of Alternatives Development, Screening, and Evaluation Process 8-3

ACRONYMS AND ABBREVIATIONS

AA	Alternatives Analysis
BAT	business access and transit
BRT	bus rapid transit
CBD	central business district
CFR	Code of Federal Regulations
CO_2e	carbon dioxide equivalent
CWA	Clean Water Act
DAHP	Washington State Department of Archaeology and Historic Preservation
DSTT	Downtown Seattle Transit Tunnel
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	geographic information system
HCT	high capacity transit
HOV	high-occupancy vehicle
I-5	Interstate 5
ITWG	Interagency Technical Working Group
LOS	level of service
LPA	Locally Preferred Alternative
LWCF	Land and Water Conservation Fund
mph	miles per hour
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration

NRHP	National Register of Historic Places
O&M	operation and maintenance
PAC	Policy Advisory Committee
PE	Preliminary Engineering
pphd	passengers per hour per direction
PSRC	Puget Sound Regional Council
RCW	Revised Code of Washington
ROD	Record of Decision
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SEPA	State Environmental Policy Act
Sound Transit	Central Puget Sound Regional Transit Authority
SR	State Route
ST2	Sound Transit 2
ST2 Plan	Sound Transit 2 Plan
TOD	transit-oriented development
TSM	transportation systems management
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
v/c	volume to capacity
VHT	vehicle hours traveled
VMT	vehicle miles traveled
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSDOT	Washington State Department of Transportation

North Corridor Transit Project
Alternatives Analysis Report

SUMMARY

S.1 INTRODUCTION

The Central Puget Sound Regional Transit Authority (Sound Transit) intends to expand regional transit service in the North Corridor, connecting the existing regional transit system from the planned interim terminus of Link light rail in the Northgate neighborhood of Seattle to the city of Lynnwood in southern Snohomish County. Construction is currently underway on a light rail extension from downtown Seattle to the University of Washington, which is scheduled to open in 2016, followed by service to Northgate, which is targeted to open in 2021. Approved by voters as part of the Sound Transit 2 (ST2) Plan in 2008, the North Corridor Transit Project would extend regional transit service northward to serve north Seattle, Shoreline, Mountlake Terrace, and Lynnwood.

What is the Sound Transit 2 (ST2) Plan?

On Nov. 4, 2008, voters of the Central Puget Sound region approved the Sound Transit 2 (ST2) ballot measure, which will add regional express bus and commuter rail service while building 36 additional miles of light rail to form a 55-mile regional system. ST2 will expand the existing light rail system to serve three major travel corridors – extending from North Seattle into Snohomish County (the North Corridor project), across Lake Washington into East King County, and south of SeaTac International Airport to Federal Way. ST2 will also expand Sounder commuter rail and ST Express regional bus service significantly.

The North Corridor Transit Project is an incremental step in implementing the Puget Sound Regional Council's (PSRC's) VISION 2040 Regional Plan and the Sound Transit 2005 Regional Transit Long-Range Plan. Both call for the eventual extension of high-capacity transit (HCT) service north to Everett. Figure S-1 shows the Regional Transit System Plan map.

The North Corridor Transit Project relies on receiving federal assistance to complete the project. In accordance with federal regulations and guidelines for fixed guideway projects that seek New Starts grant funds from the Federal Transit Administration (FTA), Sound Transit has completed an Alternatives Analysis (AA) to evaluate a range of potential alternatives for addressing mobility needs in the North Corridor, including routes, stations, and operating features.

The purpose of the AA is to define the transportation needs in the corridor; identify, evaluate, and narrow alternatives that would address the needs of the corridor; and help Sound Transit select a preferred transit mode and route for implementation. While an AA is a local process, FTA provides general guidelines for how to conduct it. These include four major steps: study initiation, development and refinement of alternatives and technical methodologies, analysis and evaluation, and selection of the Locally Preferred Alternative (LPA) or proposed action.

What is PSRC's VISION 2040 Regional Plan?

VISION 2040, adopted in April 2008, is a regional strategy for accommodating the additional 1.7 million people and 1.2 million new jobs expected to be in the region by the year 2040. It is the result of a process undertaken by the region's elected officials, public agencies, interest groups, and individuals to establish a common vision for the future of the region. VISION 2040 contains an environmental framework, a regional growth strategy, policies to guide growth and development, implementation actions, and measures to monitor progress. One of the key elements of the vision is to concentrate population and employment growth in regionally designated growth centers that are well connected by major transportation corridors and high capacity transit.

What is High Capacity Transit (HCT)?

High capacity transit or HCT is defined in Sound Transit's enabling legislation as a system of public transportation services within an urbanized region operating principally on exclusive rights-of-way, and the supporting services and facilities necessary to implement such a system. HCT can also include interim express services and high occupancy vehicle lanes. Taken as a whole, HCT elements provide a substantially higher level of passenger capacity, speed, and service frequency than traditional public transportation systems operating principally in general purpose roadways. *(Definition included in Sound Transit's enabling legislation (RCW 81.104.015 (2))*

Northgate Transit Center

Lynnwood Transit Center

Figure S-1. Sound Transit 2 Regional Transit System Plan Map and North Corridor

The North Corridor AA includes a public and agency outreach program and state and federal environmental review processes consistent with both the National Environmental Policy Act (NEPA) and Washington's State Environmental Policy Act (SEPA) requirements. Because the project has the potential to cause environmental impacts, the project will require an Environmental Impact Statement (EIS).

S.2 NORTH CORRIDOR PURPOSE AND NEED

Sound Transit is proposing the North Corridor project to improve regional transit service from Seattle, north into Snohomish County. The North Corridor area is part of the region's most heavily traveled corridor that links the cities of Tacoma, Seattle, and Everett. Figure S-2 shows the geographic setting for the North Corridor as well as its relationship to the Link light rail system. The project has been initiated in response to the public vote in November 2008 authorizing local funding for the North Corridor project as part of the ST2 Plan.

Sound Transit's legislative mandate is to improve public transportation and mobility in the central Puget Sound region by developing an HCT system. This system would operate principally on exclusive rights-of-way and provide a substantially higher level of passenger capacity, speed, and service frequency than traditional public transportation systems operating principally in general purpose roadways.

The corridor currently has express bus service operating in the Interstate 5 (I-5) high-occupancy vehicle (HOV) lanes, utilizing HOV direct access and freeway transit station facilities at Lynnwood and Mountlake Terrace, respectively. This service has reliability problems because the HOV system is incomplete and is highly congested during peak periods; as a result, the express bus system does not adequately meet the growing transit needs of the corridor. The highest demand for the service is during

I-5 north of Northgate in Seattle

the congested peak commute periods, as travelers from residential areas in King and Snohomish counties travel south to major job centers in Seattle and east King County, or north toward Everett.

To guide decision-making during the AA and through the project's state and federal environmental processes, Sound Transit has developed a statement of the project's purpose and need. An earlier draft statement was presented for public review and comment during an early scoping and public comment period held in September and October 2010, and was refined based on comments received.

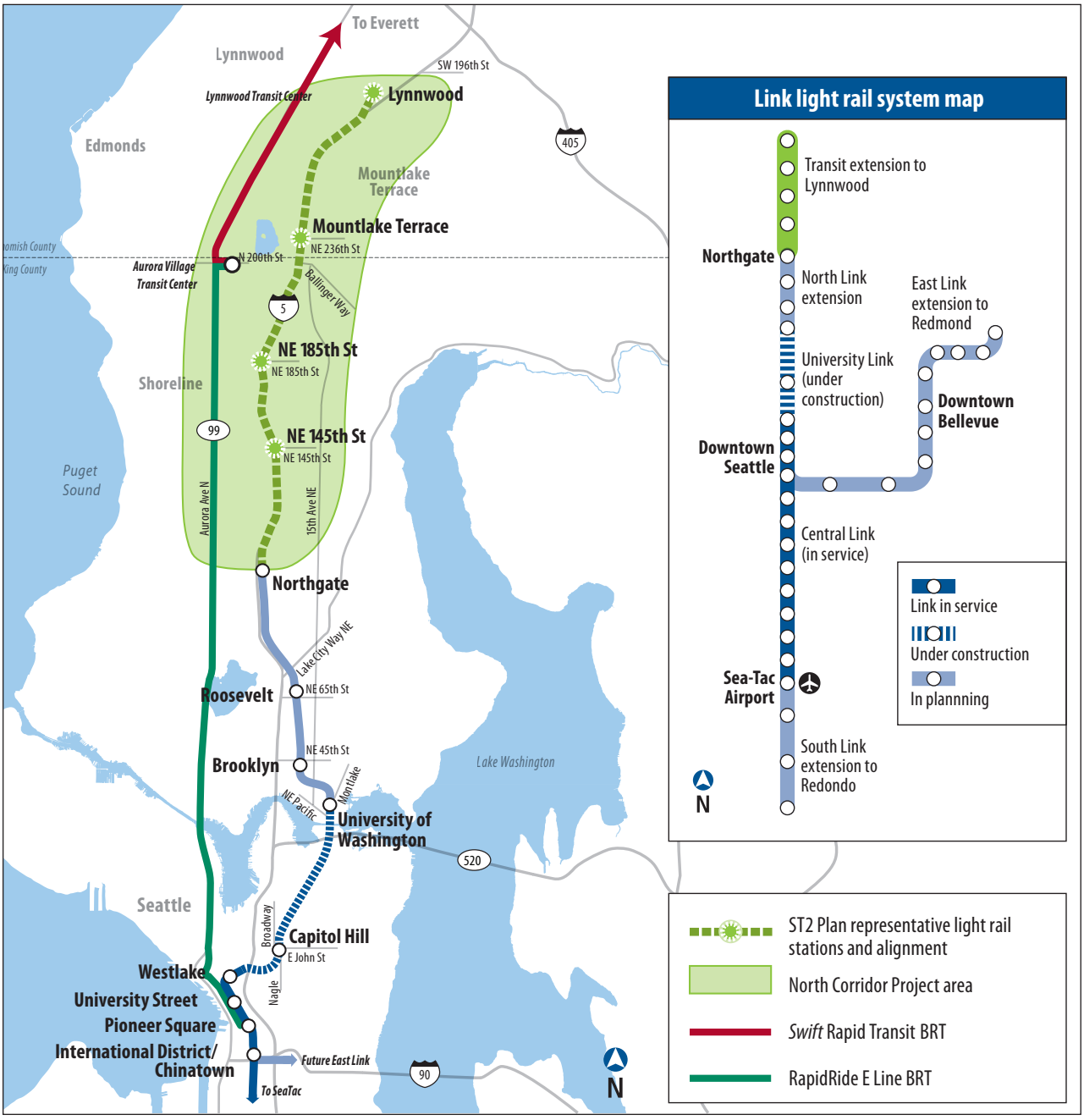


Figure S-2. North Corridor Project Area and Relation to Link Light Rail System

The Purpose of the North Corridor Transit Project

Improve regional mass transit service from Seattle north into Snohomish County by:

1. Providing reliable, rapid, and efficient two-way, peak and off-peak transit service of sufficient capacity to meet the existing and projected demand between the communities and activity centers located in the North Corridor and the other urban centers in the Central Puget Sound area;
2. Providing a mobility alternative to travel on congested roadways, and improving connections to the regional multimodal transportation system;
3. Supporting North Corridor communities' and the region's adopted land use, transportation and economic development vision, which promotes the well-being of people and communities, ensures economic vitality and preserves a healthy environment; and
4. Supporting the long-range vision, goals, and objectives for transit service established by Sound Transit's Long-Range Plan for high quality regional transit service connecting major activity centers in King, Pierce and Snohomish counties, including a connection between Seattle and Everett.

The North Corridor Transit Project is Needed to:

- Meet the rapidly growing needs of the corridor and the region's future residents and workers by increasing mobility, access, and transportation capacity to and from regional growth and activity centers in the North Corridor and the rest of the region, as called for in the region's adopted plans, including the PSRC's VISION 2040 and Transportation 2040, as well as related county and city comprehensive plans.
- Address the problems of increasing and unreliable travel times for transit users in the North Corridor, who are now dependent on the corridor's highly congested roadway and HOV systems.
- Address overcrowding facing current and future North Corridor transit riders due to insufficient capacity of the current transit system.
- Provide an alternative to automobile trips on I-5 and SR 99, the two primary highways serving the corridor, which are unreliable and over capacity throughout significant portions of the day.
- Implement the long-range vision for HCT service established by Sound Transit's Long Range Plan, with a regional transit investment that supports economic vitality, preserves the environment, preserves communities, and allows for the future extension of HCT north to Everett.
- Ensure long-term regional mobility, multimodal connectivity, and convenience for North Corridor citizens and communities, including travel-disadvantaged residents and low income and minority populations.
- Provide the transit infrastructure needed to support the development of Northgate and Lynnwood as designated regional growth centers providing housing, employment, public services, and multimodal transportation connections.
- Help support the environmental and sustainability goals of the state and region, including state regulations setting goals for reducing annual per capita vehicle miles traveled by 2050, in accordance with RCW 47.01.440, and the reduction of greenhouse gas emissions (Limiting Green House Gas Emissions, Chapter 702.35).

S.3 DEVELOPMENT, SCREENING, AND EVALUATION OF ALTERNATIVES

The alternatives development, screening, and evaluation process consists of the stages illustrated in Figure S-3 and summarized below:

Pre-Screening: Before the start of the concept development, pre-screening was conducted to assess whether concept ideas were consistent with the definition of the North Corridor as identified in Sound Transit's 2005 Regional Transit Long-Range Plan and whether they met the project's purpose and need. Those concept ideas that failed this pre-screening were dropped from further development.

Initial Concept Screening and Alternatives Development: The concept ideas that survived pre-screening were developed further and then screened against a set of general criteria based on the project's purpose and need. The surviving concepts were then refined to form the Level 1 alternatives.

Level 1 Alternatives Evaluation: The Level 1 evaluation employed quantitative and qualitative assessments of benefits, impacts, and costs of a refined set of alternatives. The best performing alternatives were carried forward, modified, and refined for the Level 2 evaluation. Poorly performing alternatives were dropped from further consideration.

Level 2 Alternatives Evaluation: The Level 2 evaluation involved detailed analysis of further refined alternatives using more quantitative information. Based on this evaluation, the most promising alternatives may be evaluated in the formal NEPA/SEPA environmental review process.

The purpose and need was used to develop the screening and evaluation criteria and measures; these criteria are grouped by six broad categories each related to a portion of the purpose and need statement, as illustrated in Figure S-4.

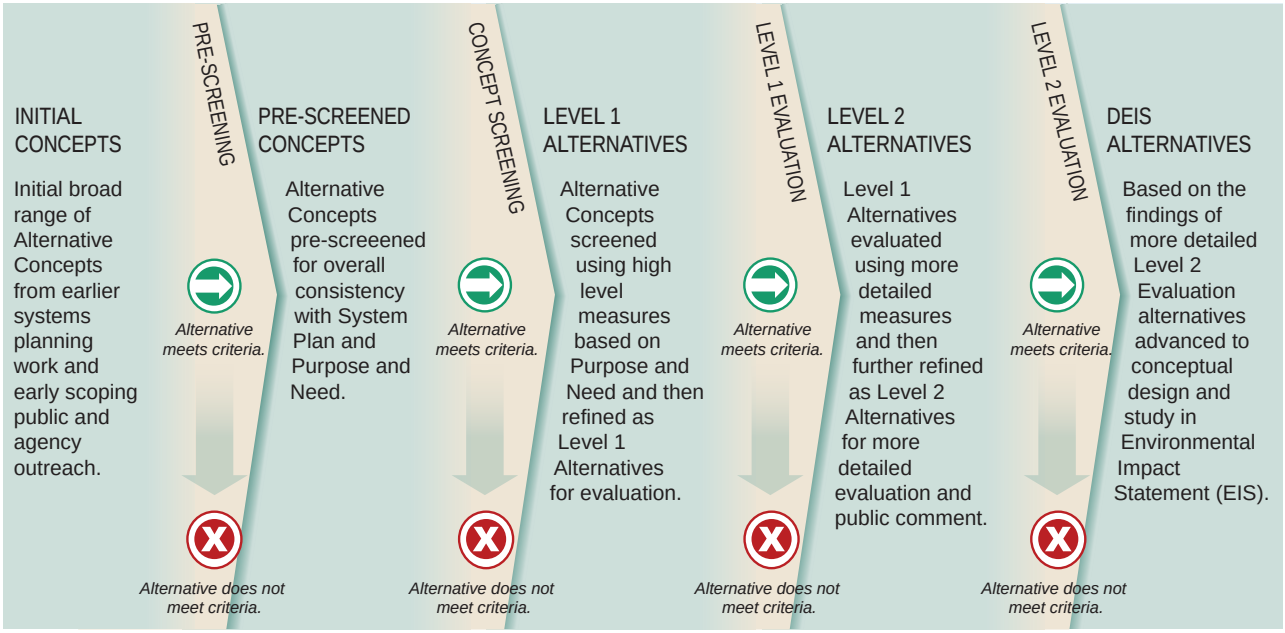

INITIAL CONCEPTS
Initial broad range of Alternative Concepts from earlier systems planning work and early scoping public and agency outreach.
PRE-SCREENING
Alternative meets criteria.
Alternative does not meet criteria.
PRE-SCREENED CONCEPTS
Alternative Concepts pre-screeened for overall consistency with System Plan and Purpose and Need.
CONCEPT SCREENING
Alternative meets criteria.
Alternative does not meet criteria.
LEVEL 1 ALTERNATIVES
Alternative Concepts screened using high level measures based on Purpose and Need and then refined as Level 1 Alternatives for evaluation.
LEVEL 1 EVALUATION
Alternative meets criteria.
Alternative does not meet criteria.
LEVEL 2 ALTERNATIVES
Level 1 Alternatives evaluated using more detailed measures and then further refined as Level 2 Alternatives for more detailed evaluation and public comment.
LEVEL 2 EVALUATION
Alternative meets criteria.
Alternative does not meet criteria.
DEIS ALTERNATIVES
Based on the findings of more detailed Level 2 Evaluation alternatives advanced to conceptual design and study in Environmental Impact Statement (EIS).
Alternative advances.
Alternative does not advance.

Figure S-3. Alternatives Analysis Evaluation Framework

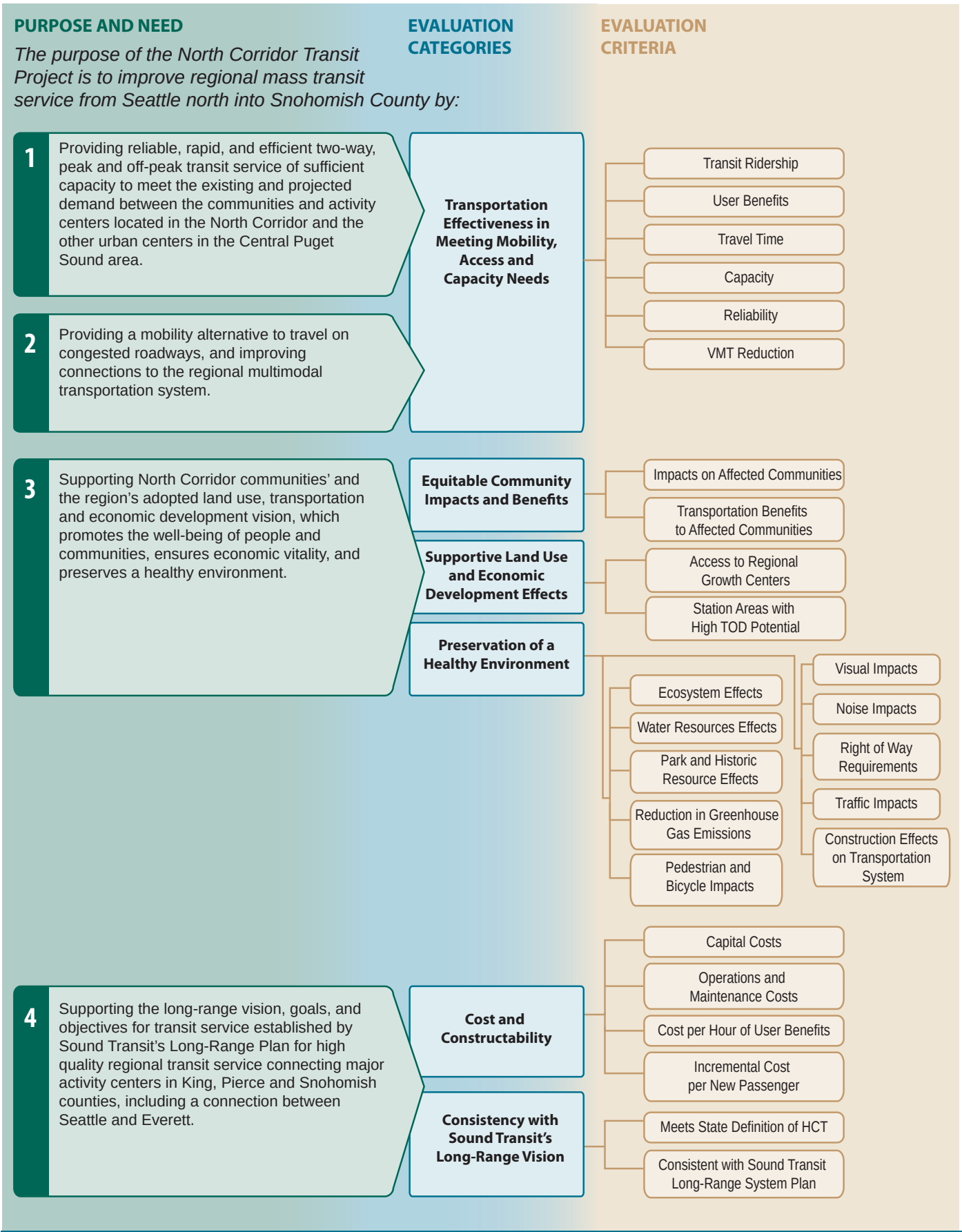

PURPOSE AND NEED
The purpose of the North Corridor Transit Project is to improve regional mass transit service from Seattle north into Snohomish County by:
EVALUATION CATEGORIES
EVALUATION CRITERIA
1
Providing reliable, rapid, and efficient two-way, peak and off-peak transit service of sufficient capacity to meet the existing and projected demand between the communities and activity centers located in the North Corridor and the other urban centers in the Central Puget Sound area.
2
Providing a mobility alternative to travel on congested roadways, and improving connections to the regional multimodal transportation system.
Transportation Effectiveness in Meeting Mobility, Access and Capacity Needs
Transit Ridership
User Benefits
Travel Time
Capacity
Reliability
VMT Reduction
3
Supporting North Corridor communities' and the region's adopted land use, transportation and economic development vision, which promotes the well-being of people and communities, ensures economic vitality, and preserves a healthy environment.
Equitable Community Impacts and Benefits
Impacts on Affected Communities
Transportation Benefits to Affected Communities
Supportive Land Use and Economic Development Effects
Access to Regional Growth Centers
Station Areas with High TOD Potential
Preservation of a Healthy Environment
Ecosystem Effects
Water Resources Effects
Park and Historic Resource Effects
Reduction in Greenhouse Gas Emissions
Pedestrian and Bicycle Impacts
Visual Impacts
Noise Impacts
Right of Way Requirements
Traffic Impacts
Construction Effects on Transportation System
4
Supporting the long-range vision, goals, and objectives for transit service established by Sound Transit's Long-Range Plan for high quality regional transit service connecting major activity centers in King, Pierce and Snohomish counties, including a connection between Seattle and Everett.
Cost and Constructability
Capital Costs
Operations and Maintenance Costs
Cost per Hour of User Benefits
Incremental Cost per New Passenger
Consistency with Sound Transit's Long-Range Vision
Meets State Definition of HCT
Consistent with Sound Transit Long-Range System Plan

Figure S-4. Relationship of Purpose and Need to Evaluation Categories and Criteria

S.4 EARLY PUBLIC AND AGENCY INVOLVEMENT

Sound Transit undertook a substantial public and agency outreach effort early in the AA process to gather input on the project's purpose and need, the evaluation and screening criteria, and the initial alternatives. Sound Transit and FTA undertook early scoping to engage the public and stakeholders in the AA process, before defining formal alternatives that would be evaluated in the AA. The early scoping process for the North Corridor Transit Project began September 24, 2010, with a series of public notices, advertisements, and mailings, and continued through October 27, 2010. Three public meetings and an agency meeting were held, and public comments were received in a wide variety of formats.

The project also used an online questionnaire tool, which was available on the project Web site **(http://www.soundtransit.org/NorthHCT)** throughout the early scoping period. Nearly 275 people completed the questionnaire, and almost half of them submitted additional informal written comments at the end of their entry. Nearly 90 written comment letters were received; nine of these comment letters were provided by state and local agencies.

Project open house

KEY THEMES

Several key themes emerged from the public meetings and online questionnaire tool regarding the alternatives as follows:

- Light rail was the mode suggested by most participants, which was expected because voters had recently approved local funding for light rail in the 2008 ST2 ballot measure.
- Most people said that ease of access to the regional transit system was important, including strong east-west connections with coordinated and direct feeder buses, sufficient park-and-ride capacity, and easy bicycle and pedestrian access.
- Most people identified either I-5 or State Route (SR) 99 as appropriate routes for the system. Several thought 15th Avenue NE should be considered.
- Responses about potential station areas and numbers of stations were mixed. Many people understood why the planned location of system termination is at the Lynnwood Transit Center, but many asked if it could be extended farther north to Alderwood Mall. Many people thought the new Mountlake Terrace Transit Center could provide good access to the system, whereas comments varied about potential southern station areas on I-5 and potential station areas on SR 99.
- Overall, participants wanted to know more about the potential trade-offs and impacts of the project. Some expressed concerns about how the project would be affected by Sound Transit's current financial situation and trade-offs being explored by the Sound Transit Board.

S.5 CONCEPT DEVELOPMENT AND SCREENING

The North Corridor is characterized by a very mature and well-used public transit system operated by three public transit agencies, along with supporting transit and HOV facilities developed and maintained by the Washington State Department of Transportation (WSDOT). The project area also has a long and rich history of transportation studies aimed at addressing many of the issues identified in the project's purpose and need. The findings of the ST2 system planning and other previous studies, as well as input from agency staff and the public through early scoping, were the basis for the development of the initial alternative concepts.

Bus traveling in I-5 HOV lanes in Mountlake Terrace

Link Light Rail in downtown Seattle

Adopted plans in the region call for light rail transit, linking the region's four major regional centers—Everett, Seattle, Tacoma, and Bellevue. Connecting the interim light rail terminus at Northgate with Lynnwood is a key component of the ultimate connection to Everett. As a result, this North Corridor segment will ultimately serve a large "through" movement market—requiring sufficient capacity and service levels (i.e., frequent service, high speeds, and reliability) necessary for this critical connection between Everett and Seattle.

The Seattle central business district (CBD) is the single largest market for transit trips from the North Corridor; the second largest market for transit trips is the University District. As a result, alternative concepts were developed to provide a high level of service to these activity centers, both in terms of capacity and speed. Ideally, this is accomplished by providing a one-seat ride on the regional transit system to both downtown Seattle and the University District from the North Corridor. In addition to serving the two primary regional center destinations, another need is to improve regional access to the North Corridor communities from all other activity centers. The existing regional express bus system adequately connects (albeit with the inherent traffic, congestion-related reliability, and travel time problems) the project area to the Seattle CBD and the University District. However, travel to other major centers is poorly served by this system.

The concept development process resulted in the identification of a large number of bus and light rail concepts to meet the identified transportation needs in the corridor.

S.5.1 Concepts Eliminated in Pre-screening

Before the start of initial concept screening, a pre-screening was conducted to assess

whether the concepts were consistent with the definition of the North Corridor Transit Project as identified in Sound Transit's 2005 Regional Transit Long-Range Plan and whether the concepts would contribute to the project's purpose and need. Most concepts considered passed this pre-screening step. The following concepts did not:

Lake City Way/SR 522 Corridor: This concept would use Lake City Way/SR 522 to connect Northgate to Lynnwood. SR 522/Lake City Way lies to the east of the study corridor and runs generally northeast-southwest. The SR 522/Lake City Way alignment is longer than any other route considered and does not connect the communities and travel markets served by the current major north-south transit system the project is intended to improve. In Sound Transit's Long-Range Plan, the SR 522 corridor is separate and distinct from the North Corridor, primarily as a result of differing travel patterns, and is subject to a separate project development process. In addition, because of its location, a Lake City Way/SR 522 alignment is not consistent with the project's purpose and need related to transportation effectiveness; therefore, it was eliminated from further consideration.

Light Rail in Mixed Traffic: For this concept, light rail would be located at-grade on SR 99 or 15th Avenue NE, operating in mixed general purpose traffic or mixed with buses in business access and transit (BAT) lanes. Earlier system planning concluded that surface light rail operating in mixed traffic would have insufficient capacity, slow average speeds, and low reliability, and thus would not provide the kind of regional service called for in Sound Transit's Long-Range Plan. Light rail in mixed traffic does not meet the project's purpose and need related to transportation effectiveness and was eliminated from further consideration.

Example of light rail mixed with traffic in Portland, Oregon

S.5.2 Concepts Carried Forward for Development and Screening

In addition to a No Build Alternative and a Transportation Systems Management (TSM)/Baseline Concept, seven build concepts were judged promising enough to be screened as part of the development of Level 1 alternatives. The initial light rail concepts are shown in Figure S-5 and the bus rapid transit (BRT) concepts are shown in Figure S-6. The initial alternatives include the following:

No Build Concept: The No Build Concept includes only those improvements committed to and funded for implementation by the transportation providers in the region.

TSM/Baseline Concept: The TSM concept improves the regional transit system in the project area to the greatest extent possible without making a major new capital investment.

Light Rail Concepts: Five light rail concepts and sub-concepts were identified to connect Northgate to Lynnwood, including an alignment along I-5, two concepts for an alignment along SR 99 (one at-grade and one on an elevated structure), and two concepts along 15th Avenue NE (one at-grade and one on an elevated structure).

BRT Concepts: Two BRT concepts were developed. One concept focuses on I-5 and attempts to duplicate the I-5 light rail line. The other includes BRT service along three corridors, including portions of I-5, SR 99, and 15th Avenue NE.

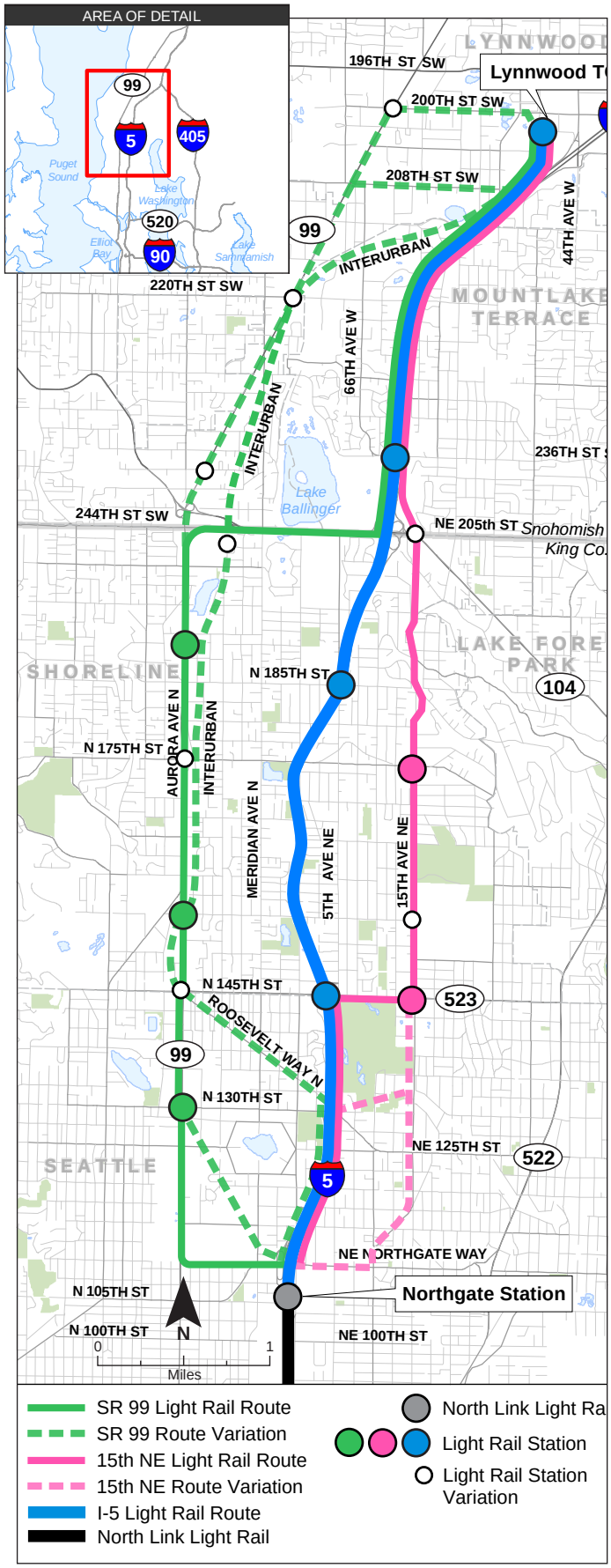


Figure S-5. Light Rail Concepts

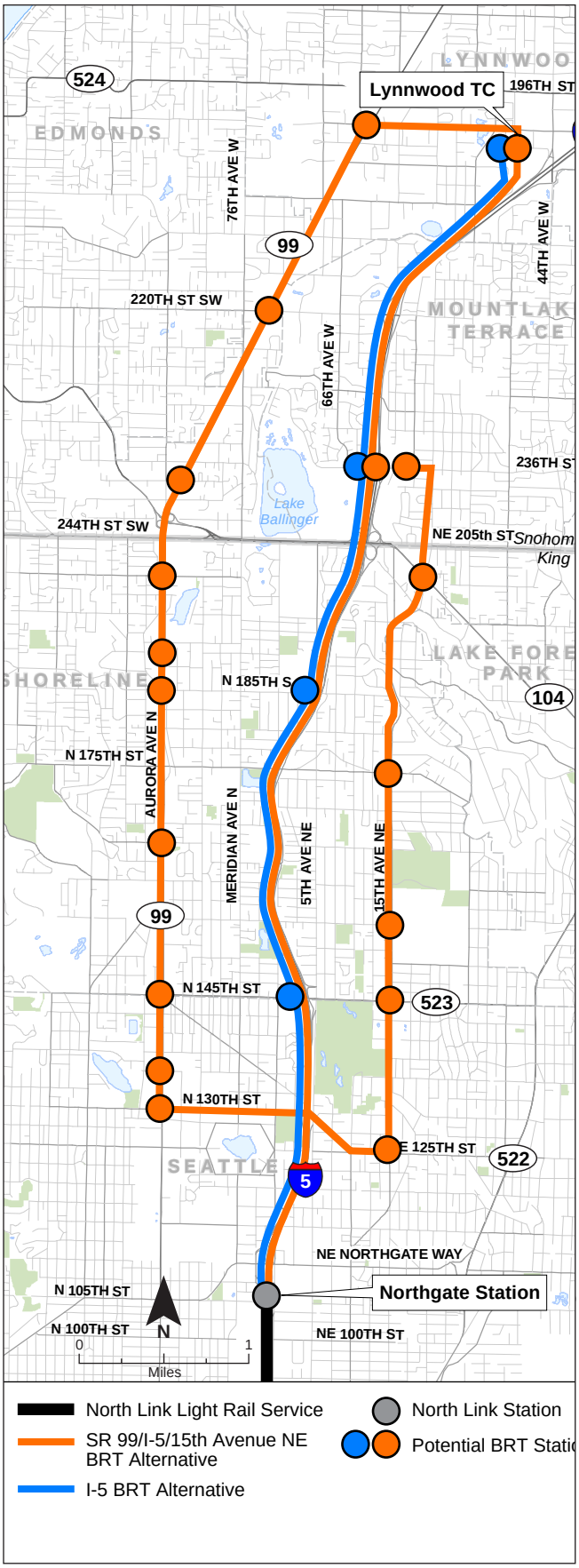


Figure S-6. BRT Concepts

Data Sources: King County, Snohomish County, WSDOT, Sound Transit

S.5.3 Concept Screening

These eight concepts were initially screened using criteria based on the project's purpose and need. This process resulted in a further refinement of the eight concepts down to five concepts that were then developed in detail as the Level 1 alternatives. During this process, the two concepts utilizing segments of 15th Avenue NE were screened from further consideration, the two concepts utilizing portions of SR 99 were refined to a single hybrid Level 1 alternative with variations, and the I-5 light rail and two BRT concepts were refined and retained for further analysis as Level 1 alternatives.

15TH AVENUE NE LIGHT RAIL CONCEPTS SCREENED OUT

The 15th Avenue NE corridor was initially considered because it is one of only three major existing north-south transportation corridors in what is a highly urbanized study area. However, unlike the other two corridors (I-5 and SR 99), 15th Avenue NE is not continuous in the study area and ends at SR 104 just south of Snohomish County. In addition, the street has a narrow right-of-way (generally 60 feet, compared to the much wider 100- to 200-foot rights-of-way for SR 99 and I-5). It is lined with numerous single and multi-family residential structures built close to the street, it operates as a neighborhood arterial, and it has been the focus of a "road diet" (narrowing) by the City of Shoreline. Based on the initial concept screening, both the elevated and at-grade concepts for light rail in 15th Avenue NE were dropped from further consideration as discussed below.

15th Avenue NE Elevated Light Rail Concept: While an elevated light rail concept along 15th Avenue NE could meet some of the project's purpose and need related to rider benefits and transit capacity, it has no clear transportation advantages over either I-5 or SR 99 because its accessibility is more limited. In addition, the concept would have potentially serious impacts on the local communities through which elevated light rail would pass. In particular, the 15th Avenue NE Elevated Light Rail Concept does not

How the No Build Alternative was used in the AA Process

The No Build Alternative is defined to include those transportation facilities and services that are likely to exist in the forecast year. It provides the baseline against which the TSM and all build alternatives are compared in the AA process and establishes much of the information needed for development of the project's stated purpose and need. It is also the baseline for establishing the environmental impacts of the alternatives. All elements of the No Build Alternative are incorporated into each of the other alternatives except where an alternative replaces services or facilities inside the corridor.

Role of TSM/Baseline in the New Starts Process

The TSM/Baseline represents the best that can be done for mobility in the corridor without a major capital investment (e.g., constructing a new transit guideway). It provides an appropriate baseline against which the proposed transit build alternatives are compared during the New Starts rating and evaluation process and provides a "level playing field" with other transit projects competing for New Starts funds across the country.

Definition of BRT

The term bus rapid transit (BRT) covers a range of bus service operations that are, at a minimum, faster than traditional local bus or even express bus services and that, at a maximum, include grade-separated bus operations. The fundamental features of BRT systems are bus priority, faster passenger boarding, faster fare collection, all day frequent service, and a system image that is distinctly recognizable. BRT may improve mobility at relatively low cost through incremental investment in a combination of bus infrastructure, equipment, operational improvements, and technology.

meet the project's purpose and need related to supporting the region's adopted land use vision, promoting the well-being of people and communities, and preserving a healthy environment, which considers the following:

- High right-of-way impacts would occur to both residential and commercial properties. In station areas and at intersections, structures on both sides of the street could be removed.
- The alignment could adversely affect one or more parks, including the Jackson Park Golf Course, and numerous historic-era properties.
- The potential would exist for noise impacts to a substantial number of residences and other sensitive receptors, including the Fircrest School for the Developmentally Disabled.
- The scale of a roughly 30-foot-wide elevated guideway and up to 60-foot-wide, 400-foot-long elevated stations placed in the urban fabric of an existing mixed-use, built-up, narrow neighborhood arterial would have a high potential to affect neighborhood character and function, and would also include the removal of existing homes and neighborhood businesses.

15th Avenue NE At-Grade Light Rail Concept: The at-grade light rail concept along 15th Avenue NE, while avoiding the impacts of large elevated structures, performs poorly from a transportation standpoint. Capacity is roughly half of that for the grade-separated alternatives, and travel times are the longest of all the concepts. At-grade light rail on 15th Avenue NE would be limited to the posted 30-mile-per-hour (mph) speed limit and slower than the TSM/Baseline Concept. Thus, the 15th Avenue NE At-Grade Light Rail Concept does not meet purpose and need related to providing reliable, rapid, and efficient two-way transit service of sufficient capacity. This concept would have similar impacts to the 15th Avenue NE Elevated Light Rail Concept.

SR 99 FULLY AT-GRADE LIGHT RAIL ALIGNMENT SCREENED OUT

A fully at-grade configuration along SR 99 between North 130th Street and the King/Snohomish County line does not adequately meet the project's purpose and need for the following reasons:

- Travel times from Lynnwood to Northgate would be similar to the TSM/Baseline Concept and much longer than they would

15th Avenue NE in north Seattle

be with elevated light rail. As such, the fully at-grade variation would not perform well with respect to providing a relatively fast trip between regional centers.

- This variation would have multiple at-grade intersections to navigate, making it less reliable than fully grade-separated elevated options.

- This variation would have high right-of-way impacts in terms of property acquisitions needed for implementation.

- The impact on traffic at high-volume SR 99 intersections would be substantial.

As a result, this variation was not carried forward as a standalone option. Instead, only the most promising portions for using at-grade light rail were considered for integration into the Level 1 SR 99 Light Rail Alternative.

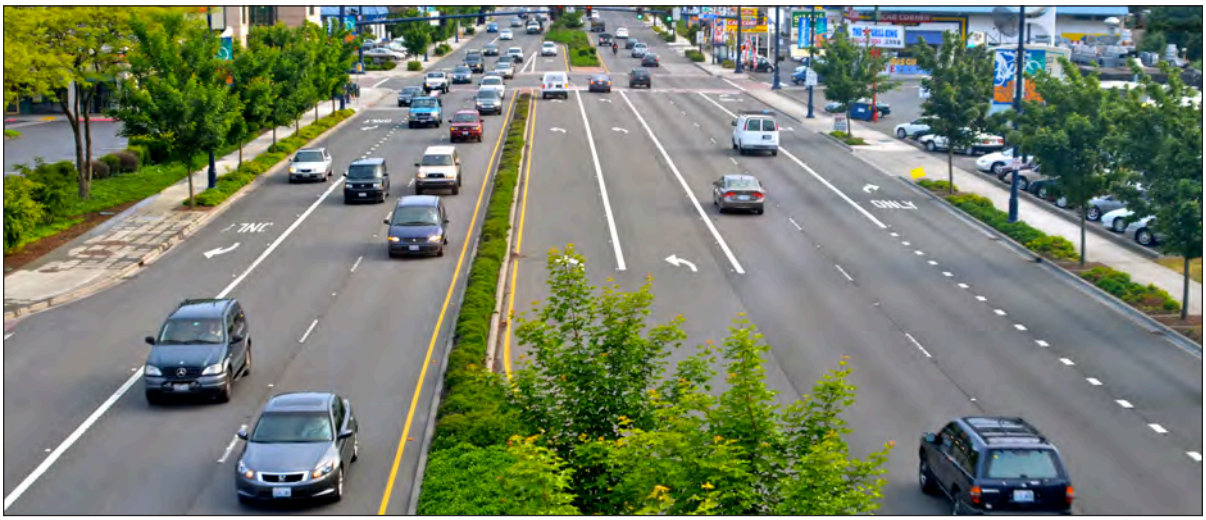
SR 99 LIGHT RAIL SUB-ALTERNATIVE ALIGNMENTS SCREENED OUT

The 130th Street Tunnel and the Interurban right-of-way variations to the SR 99 Light Rail Concept also do not adequately meet the project's purpose and need and were not considered further.

130th Street Tunnel. This variation would connect light rail to SR 99 via a tunnel under the Haller Lake neighborhood and would not allow an at-grade station in the vicinity of SR 99 and North 130th Street. Because variations via North 110th Street or Roosevelt Way North perform equally or better and appear possible to construct without tunnels, this variation was dropped from further consideration.

Former Interurban Right-of-Way. Development of a light rail alignment in the former Interurban right-of-way would require accommodating the existing and future electrical utility transmission line needs, as well as reconstructing the relatively new pedestrian and bicycle trail. Adding light rail would require legal agreements with the public power utilities, which may be difficult to obtain given the utilities' competing needs for expansion and unconstrained access to their current and future electrical power infrastructure and their pre-existing primary public use of the right-of-way.

Although ownership of the trail varies along the trail's full course within King and Snohomish counties, the right-of-way is consistently owned by public entities, and it is presumed to qualify as a Section 4(f) resource. Section 4(f) is a regulation that restricts FTA's ability to approve projects with major uses of recreation and



SR 99 in Shoreline

Former Interurban Railway

Today's Interurban Trail

park lands, particularly when other reasonable alternatives are available. In addition to the likely impacts to the Interurban Trail and its bicycle and pedestrian uses, a number of other uses are immediately adjacent. Many of these are residential, and some portions of the right-of-way appear to have been developed with other commercial and residential uses, which increases the potential for property impacts, as well as noise and visual impacts. Based on the concept screening analysis, maintaining all the current uses of the existing right-of-way would be challenging and would likely require the acquisition of substantial additional right-of-way.

Finally, following the Interurban right-of-way to Lynnwood would not allow a station at Mountlake Terrace along I-5, missing this major transit node and the adjacent city center; therefore, its mobility benefits would be much less than other alignments. As a result, given that other reasonable alignments that perform as well or better are available, an alignment that requires continuous use of large segments of the Interurban right-of-way was dropped from consideration. Using smaller portions of the right-of-way may be possible if sections of an SR 99 route prove more difficult, but not as a major route alignment option.

S.6 LEVEL 1 ALTERNATIVES DEVELOPMENT AND EVALUATION

Five general concepts for meeting the project's purpose and need were developed further in the Level 1 evaluation. Besides a No Build Alternative, the Level 1 alternatives include a TSM/Baseline Alternative, two BRT alternatives, and two light rail alternatives, each of which includes numerous sub-alternatives.

S.6.1 Level 1 Alternatives

The Level 1 alternatives included the following:

No Build Alternative: This alternative includes only those improvements committed and funded for implementation by the transportation providers in the region. This alternative assumed that the light rail system extensions approved by voters in 2008 are completed to Northgate, Overlake, and Redondo/Star Lake. The most important changes in existing transit services in the project area include King County Metro's planned revisions once light rail reaches Northgate and the implementation of the RapidRide E Line, which will connect Shoreline with downtown Seattle along SR 99.

TSM/Baseline Alternative: This alternative improves the regional bus system in the study area to the greatest extent possible short

of making a major new capital investment. Included are new express bus services connecting the Link light rail terminus at Northgate to Lynnwood, Mountlake Terrace, Shoreline, and North Seattle. Low-cost traffic engineering improvements to improve bus travel times and reliability as well as additional park-and-ride capacity are also added.

L1: I-5 Light Rail Alternative: This alternative extends light rail from Northgate to the Lynnwood Transit Center, generally in the existing I-5 right-of-way and includes four new stations, as well as supporting park-and-ride facilities and other station access improvements. This alternative includes a number of sub-alternatives for the placement of the light rail guideway and stations.

L2: SR 99 Light Rail Alternative: This alternative extends light rail from Northgate to the Lynnwood Transit Center via SR 99 through portions of Seattle, Shoreline, and Snohomish County. Two potential alignments for the southern connection through Seattle between Northgate and SR 99 are identified, as well as two options for connecting back to the Lynnwood Transit Center in Snohomish County. The portion of the light rail guideway along SR 99 would be a combination of at-grade and elevated structures (mixed profile). Five stations along with supporting park-and-ride facilities and access improvements are included in this alternative, with numerous sub-alternatives for the locations of these stations.

B1: I-5 BRT Alternative: This alternative replicates the I-5 light rail line using BRT service. Included in this alternative is the supporting infrastructure to allow BRT deployment using the HOV lanes of I-5 between the Lynnwood Transit Center and Northgate. This option includes new bus-only direct access ramps and BRT stations at 185th Street and 145th Street, along with bus-only ramps to connect the I-5 HOV lanes with an expanded transit center at Northgate. Supporting park-and-ride facilities and station access improvements are included

LEVEL 1 ALTERNATIVES ASSUMPTIONS AND GUIDING PRINCIPLES

The following assumptions and guiding principles were used in the development and refinement of the alternatives:

- Alternatives were defined for the design year 2030.
- Alternatives serve as transit extensions to the Link light rail system that will end at Northgate when the current committed projects are completed by Sound Transit. As such, the alternatives addressed the Northgate-Lynnwood project area only; no improvements for the existing and committed regional transit system south of Northgate were identified.
- Build alternatives focused on the same key travel markets, providing similar accessibility (stations, parking, and access) and levels of service (time span and headways) to make them as comparable as possible.
- Community Transit and King County Metro bus service growth was assumed to be flat (except for a 0.5 percent per year increase for scheduled maintenance hours) between fall 2009 and 2030 due to service reductions caused by the 2008 to 2010 recession and slow recovery from that recession through 2030.

Mountlake Terrace Freeway Station

Headway

Headway refers to the scheduled time between train or bus movements in a given direction. A headway of four minutes means that a train or bus is scheduled to arrive every four minutes in the given direction of travel.

and BRT service levels are similar to those included in the L1: I-5 Light Rail Alternative. This alternative also tests the possible effect on BRT operations if WSDOT eventually develops managed lanes capable of maintaining reliable 45-mph speeds along this section of I-5.

B2: Multi-Corridor BRT Alternative: This alternative includes three BRT routes to meet the travel needs of three corridors within the broader North Corridor. Routes include an I-5 Lynnwood-to-Northgate route that uses the I-5 HOV lanes and serves only the Mountlake Terrace Freeway Station; an SR 99 route that operates between Lynnwood and Northgate using the existing BAT lanes on SR 99 and accessing the I-5 HOV lanes via new bus-only direct access ramps at NE 130th Street; and a 15th Avenue NE line that begins in Mountlake Terrace and also accesses I-5 at NE 130th Street. All three routes would use new bus-only ramps connecting the I-5 HOV lanes with an expanded transit center at Northgate. Supporting park-and-ride facilities and station access improvements are also included. This alternative takes greatest advantage of the BRT infrastructure that already exists in both the SR 99 and I-5 corridors and adds transit-only I-5 HOV lane direct access ramps at NE 130th Street and at Northgate Station to and from the south only.

Link Light Rail along I-5 in Tukwila

S.6.2 Level 1 Alternatives Evaluation and Findings

The TSM/Baseline and four Level 1 build alternatives were further developed and evaluated based on a more refined set of criteria designed to measure their effectiveness in meeting the project's purpose and need. This evaluation included measures of effectiveness in meeting the North Corridor's transportation needs, including ridership potential using forecasts from Sound Transit's forecasting model. The criteria also measured each alternative's ability to support land use and economic development goals and their environmental performance. Other criteria included estimates of capital and operation and maintenance (O&M) costs.

Primary distinguishing factors among the alternatives at this level of analysis include transportation performance, consistency with the Sound Transit Long-Range Plan, environmental performance, and cost and constructability. The review found that all alternatives generally met the purpose and need's objectives for community equity, land use, and economic development and were not major differentiators among the Level 1 alternatives. These factors are likely to become more important as the alternatives are developed in greater detail and more information is known, in particular about station locations, configurations, and the fit of the alternatives into the surrounding urban environment.

TSM/BASELINE ALTERNATIVE

As would be expected, this alternative is the least effective of the alternatives in meeting the principal transportation needs when compared to the major capital investments of other alternatives. It has the lowest ridership, travel time savings, and capacity of all the build alternatives. On the positive side, it is the least costly and has the fewest likely potential impacts on the environment.

The TSM/Baseline Alternative was carried forward into the Level 2 evaluation because a refined version is needed as the baseline for the New Starts rating process used by FTA. However, as a result of the evaluation findings of the BRT alternatives, a number of additional capital facility and service improvements were added to improve the performance of the Level 2 TSM/Baseline Alternative.

L1: I-5 LIGHT RAIL ALTERNATIVE

In general, this alternative performs best judged on transportation performance criteria, with the highest ridership, shortest travel times, and greatest capacity, and it would be the most reliable of all the build alternatives. Because this alternative involves major infrastructure investment and construction along its entire length, it has the second greatest potential for impacts on the environment and is the second most costly. Only the L2: SR 99 Light Rail Alternative, which requires substantially greater amounts of new transportation right-of-way, has greater possible impacts and costs.

The L1: I-5 Light Rail Alternative was carried forward into the detailed Level 2 evaluation. Work was undertaken in consultation with WSDOT to refine the guideway concept as well as to locate and configure stations and supporting access infrastructure.

L2: SR 99 LIGHT RAIL ALTERNATIVE

In general, this alternative was the second best performing as judged on transportation performance criteria. Because this alternative involves the longest rail alignment (roughly 2 miles longer with one additional station) compared to the L1: I-5 Light Rail Alternative and largest amount of new transportation right-of-way, it has the greatest potential to affect its surroundings and is the most costly. Finally, the initial traffic and rail operations analysis raised concerns about the reliability

I-5 HOV direct access ramp in Lynnwood

of trains operating every 4 minutes in each direction through a number of intersections along the alignment.

The L2: SR 99 Light Rail Alternative was carried forward into the detailed Level 2 evaluation. Conceptual design work was undertaken to refine the alignment plan and profile as well as locate and configure stations and supporting access infrastructure. In addition, more work was undertaken related to traffic and train operations along the SR 99 at-grade segments.

B1: I-5 BRT ALTERNATIVE

In general, this alternative has similar overall transportation performance to the B2: Multi-Corridor BRT Alternative, but attracts fewer riders and has less travel time savings compared to B2. However, it is the most costly of the Level 1 bus alternatives and has the potential for higher impacts on the surrounding environment compared to the B2: Multi-Corridor BRT Alternative. The B1: I-5 BRT Alternative falls well short of the performance of the light rail alternatives

while having fewer potential impacts and substantially lower capital costs than the light rail alternatives.

The large investment in direct access ramps and new stations adjacent to I-5 at NE 145th and 185th Streets in the B1: I-5 BRT Alternative adds very little ridership compared to the combination of a new BRT line running express on I-5 through these areas and an SR 99 BRT line making stops to serve the same areas. The I-5 BRT freeway stations and ramps are costly to construct and have potential impacts on both the natural and constructed environments.

Because of its performance and cost characteristics, the B1: I-5 BRT Alternative was dropped in favor of a refined B2: Multi-Corridor BRT Alternative.

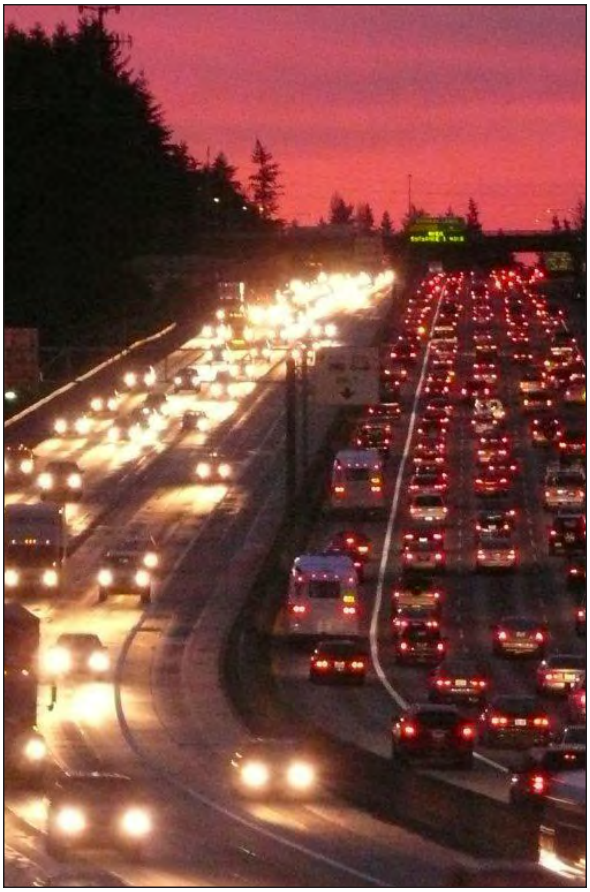
B2: MULTI-CORRIDOR BRT ALTERNATIVE

In general, this alternative is the best performing of all the bus alternatives on most criteria. It is less costly to implement than the B1: I-5 BRT Alternative and has fewer potential impacts as a result of fewer roadway additions. However, the B2: Multi-Corridor BRT Alternative falls well short of the performance of the light rail alternatives while having fewer potential impacts and substantially lower capital costs than the light rail alternatives.

Based on the Level 1 evaluation findings, a single BRT alternative with the best performing elements of the BRT alternatives evaluated so far was carried forward for detailed Level 2 evaluation.

POSSIBLE FUTURE CHANGES TO I-5 BY WSDOT

An additional consideration for the evaluation of Level 1 alternatives relates to possible future changes to I-5 that are contemplated by WSDOT. The state's and region's long-range transportation plans call for eventual development of managed lanes along the portion of I-5 in the North Corridor Transit Project area. WSDOT is considering a number of options that could result in reconstruction and tolling of portions of the freeway to include one or more managed lanes in each direction of I-5 between Northgate and Lynnwood.



I-5 in Shoreline

At this time, the design, construction costs, right-of-way, transportation system, and environmental impacts of these improvements are not known and the project is not a part of the alternatives developed to meet the purpose and need of the North Corridor Transit Project. However, if implemented and successfully managed, these improvements could reduce average peak period travel times by as much as 5 minutes between Lynnwood and Northgate

and provide better reliability for buses operating in this section of I-5.

A sensitivity test undertaken as part of the Level 1 forecasting work concluded that the impacts to ridership on the I-5 BRT line would be minor. Although increasing peak-period running speeds to 45 mph would increase overall transit ridership on I-5 compared to the B1: I-5 BRT Alternative, nearly all the benefits would accrue to Community Transit's express routes to downtown Seattle and the University District rather than the Lynnwood to Northgate BRT line. This occurs because, unlike Community Transit's express routes, the BRT line must exit and re-enter the managed lanes numerous times to serve stations between Lynnwood and Northgate.

What are Managed Lanes?

Managed lanes can be defined as highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions. They differ from traditional forms of lane management strategies in that they involve ongoing monitoring and active management, and may involve using more than one operational strategy. Operational strategies typically involve one or a combination of the following: pricing (e.g., tolled lanes), vehicle eligibility (e.g., high-occupancy toll (HOT) lanes or bus only facilities), and/or access control (e.g., reversible express lanes with limited access points). WSDOT is currently studying these types of strategies for providing mobility options in the I-5 corridor.

S.7 LEVEL 2 ALTERNATIVES

In addition to the No Build and TSM/Baseline Alternatives, light rail in the I-5 and SR 99 corridors and BRT in the I-5, SR 99, and 15th Avenue NE corridors were carried forward into Level 2. The No Build Alternative remained unchanged from Level 1, but further concept development work resulted in the development of a more robust TSM/Baseline Alternative, two light rail alternatives on SR 99 (one fully elevated and one with a mixed profile similar to the Level 1 alternative), a more refined mixed profile alternative on I-5, and a more refined Multi-Corridor BRT Alternative. The primary elements of these alternatives are shown in Figures S-7, S-8, S-9, S-11, and S-12 and discussed in the following sections.

Level of Detail of the Alternatives

For the purposes of comparison in AA, alternatives are developed at a general conceptual level sufficient to determine major trade-offs in performance, costs and possible impacts. At this level it is not possible to account for possible impact avoidance or mitigation. In general, even at Level 2 alternatives represent a family of concepts with many possible variations. Those alternatives judged most promising at each stage of the AA are developed in greater detail, but it is not until later design phases, following more detailed studies of sub-alternatives, that specific design elements are determined.

S.7.1 TSM/Baseline Alternative

The Level 2 TSM/Baseline Alternative is a modified version of the alternative evaluated during Level 1, as summarized in Figure S-7. Based on the findings of the Level 1 evaluation of the TSM/Baseline Alternative and the two BRT alternatives, a number of service changes and low-cost improvements appear promising and were added to the former. The primary elements of the Level 2 TSM/Baseline Alternative are three new express bus routes:

I-5: A route via I-5 connecting the existing Lynnwood Transit Center with the Link light

rail station at Northgate, with a stop at the existing Mountlake Terrace Transit Center freeway station.

SR 99: A route connecting the existing Edmonds Park-and-Ride with the Link light rail station at Northgate via SR 99, North 175th Street, and I-5. The route includes stops at 220th Street SW in Edmonds, an expanded Shoreline Park-and-Ride and Transit Center, North 175th Street and Meridian Avenue, and the existing NE 145th Street freeway flyer stop on I-5. This route would serve as an express service complementing the existing *Swift* and RapidRide BRT services. While sharing stations, facilities, and the BAT lanes, *Swift* and RapidRide services have much more frequent stops than the new express line.

15th Avenue NE: A route connecting the existing Mountlake Terrace Park-and-Ride and Transit Center with Northgate via 236th Street SW, 56th Avenue West, 19th Avenue NE, 15th Avenue NE, NE 175th Street, and I-5, with stops at Ballinger Way, NE 175th Street/15th Avenue NE, and the NE 145th Street freeway flyer stop.

In addition to the new express bus routes, the TSM/Baseline Alternative includes a number of new park-and-ride facilities; improvements and expansions at existing stations and park-and-ride facilities; as well as a number of modest cost traffic engineering, roadway, and signalization improvements to enhance the service additions. Also, the TSM/Baseline Alternative includes improvements in the Northgate area to provide buses with a shorter and more reliable route between I-5 and the Link light rail station. These improvements include the addition of a transit-only lane extending from the beginning of the I-5 southbound off-ramp to the intersection of Northgate Way, and then eastbound under the I-5 mainline in an added transit-only lane to the intersection of Northgate Way/1st Avenue NE, and then southbound for a short distance along 1st Avenue NE.

Similarly, a new northbound transit-only left-turn lane to supplement the existing left-turn lane at the intersection of 1st Avenue NE and the I-5 northbound on-ramp would provide travel time savings and improved reliability for northbound bus service accessing I-5.

Metro RapidRide Station

Mountlake Terrace Transit Center

FEATURES AND SERVICE

Three new express bus routes
Daily Service: 19.5 hours

Edmonds Park and Ride to Northgate: Route connects Edmonds Park and Ride with Northgate Light Rail Station
Intermediate Stops: 4
Headways (Peak Hours): 12 minutes
Headways (Off-peak Hours): 15 minutes

Lynnwood to Northgate: I-5 route connects Lynnwood Transit Center with Northgate Light Rail Station
Intermediate Stops: 1
Headways (Peak Hours): 3.75 minutes
Headways (Off-peak Hours): 15 minutes

Mountlake Terrace to Northgate: Route connects the existing Mountlake Terrace Park and Ride and Transit Center with Northgate Station
Intermediate Stops: 3
Headways (Peak Hours): 15 minutes
Headways (Off-peak Hours): 30 minutes

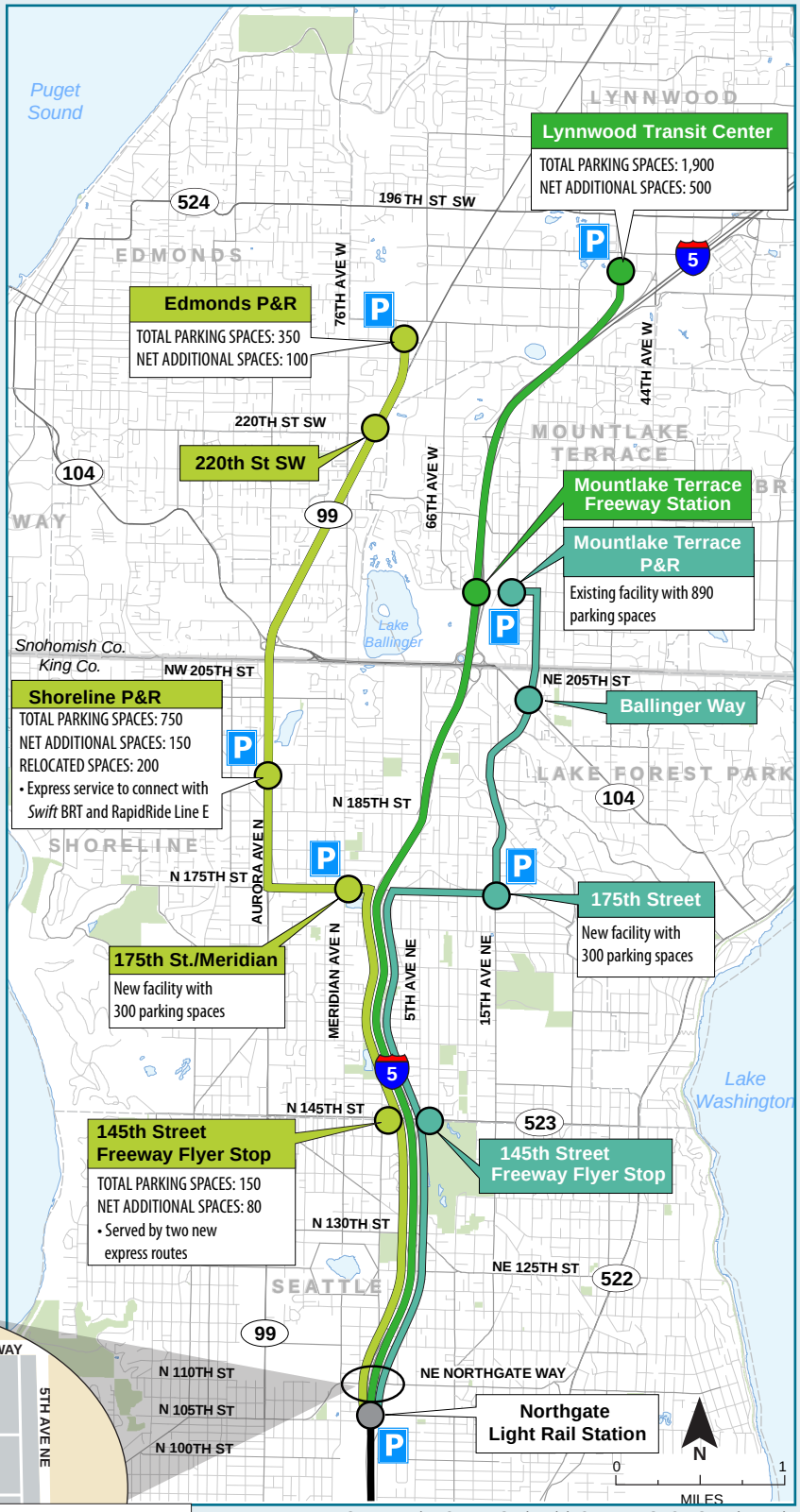
Park and Rides: New facilities, plus improvements and expansions at existing stations and park and ride facilities

Transit Access: Improvements to/from I-5 at Northgate

Roadway and signalization improvements

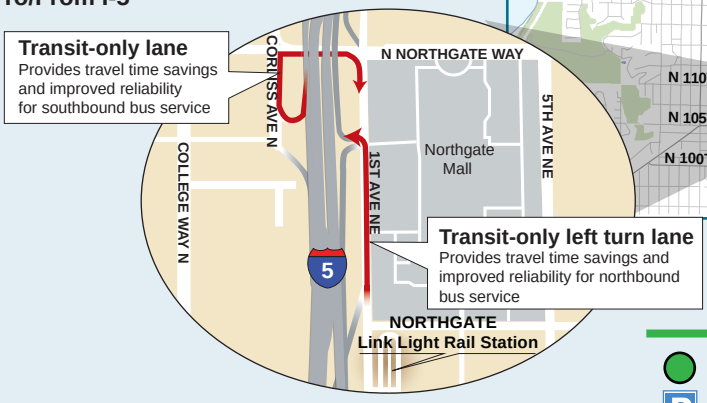
CHANGES TO EXISTING SERVICE

- King County Metro Routes 301 and 303 replaced by Edmonds Park and Ride to Northgate Express Route
- Community Transit routes serving Aurora Village Transit Center extended south to Shoreline P&R
- King County Metro routes serving Aurora Village Transit Center truncated at the Shoreline P&R



Data Sources: King County, Snohomish County, WSDOT, Sound Transit

Transit Access Improvements To/From I-5



New Express Bus Route
Express Bus Stop
Parking Available at Station
North Link Light Rail
North Link Station

Figure S-7. TSM/Baseline Alternative

S.7.2 L1: I-5 Light Rail Alternative

The L1: I-5 Light Rail Alternative advanced to Level 2 evaluation is similar to the alternative assessed during Level 1 evaluation. However, for Level 2 evaluation, the alignment was refined to take advantage of opportunities to place both the guideway and stations at ground level.

In general, placing the rail line at the same level as I-5, where possible, based on available right-of-way, topography, and other conditions, has numerous advantages over placing the line on aerial structure. In addition to reducing costs, ground-level placement has the potential to minimize visual and noise impacts on adjacent land uses and provides easier access for maintenance.

The alignment refinement resulted in a combination of an elevated and at-grade double-track rail line from Northgate to the Lynnwood Transit Center with intermediate stations at NE 145th Street, NE 185th Street, and SW 236th Street as shown in Figure S-8. Because of the topography along this section of I-5, many of the light rail ground-level sections would be in retained cut-and-fill sections adjacent to the freeway. Much of the line can be located within the existing freeway right-of-way, but there are a number of locations where additional property would need to be acquired either for the guideway or for station facilities and park-and-ride structures.

The line starts at the Link light rail station at Northgate on the east side of I-5, which is now in final design and scheduled to open for service in 2021, and ends at the existing Lynnwood Transit Center on the west side of I-5. Because of the difficulties, impacts, and costs of crossing the freeway, the approach to alignment development at this stage was to minimize the number of times that the alignment crosses I-5. For the sections through Seattle and Shoreline, little if any space is available in the I-5 median, so the only alignments that avoid major roadway reconstruction are along the east or west side of the freeway. In Snohomish County, the I-5 median is wide enough to become a possible location for the light rail infrastructure without needing to rebuild the freeway.

The North 145th Street Station is best located on the east side of I-5, where an existing park-and-ride lot and other available right-of-way provide land to site the station, guideway, and a parking structure. The NE 185th Street Station could be sited on either the east or west side of I-5, but the light rail guideway is more ideally located on the east side to serve

Elevated light rail

Light rail in retained cut

FEATURES AND SERVICE

Profile: Approximately 8.5 miles of elevated and ground-level double-track light rail

Service: Light Rail

Maximum Number of Vehicles: 4

Daily Service: 20 hours

Headways (Peak Hours): 4 minutes

Headways (Off-peak Hours): 10 minutes

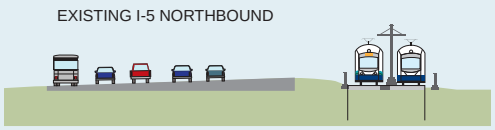
Intermediate Stations: 3

CHANGES TO EXISTING SERVICE

- Community Transit Route 112 to serve the Mountlake Terrace Station
- Local King County Metro routes in north King County would be adjusted to serve light rail
- All of Community Transit's south Snohomish County commuter routes to the University of Washington and downtown Seattle reallocated to provide feeder service to the Lynnwood, Mountlake Terrace, or 185th Street stations
- All Sound Transit routes from Snohomish County to Seattle terminate at Lynnwood Transit Center
- King County Metro commuter routes connecting with downtown Seattle, Overlake, and the University District (e.g., 242, 301, and 304) replaced with modified routes connecting to the light rail stations

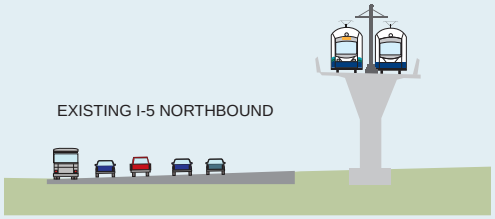
Typical At-grade Cross-section

East Side of I-5

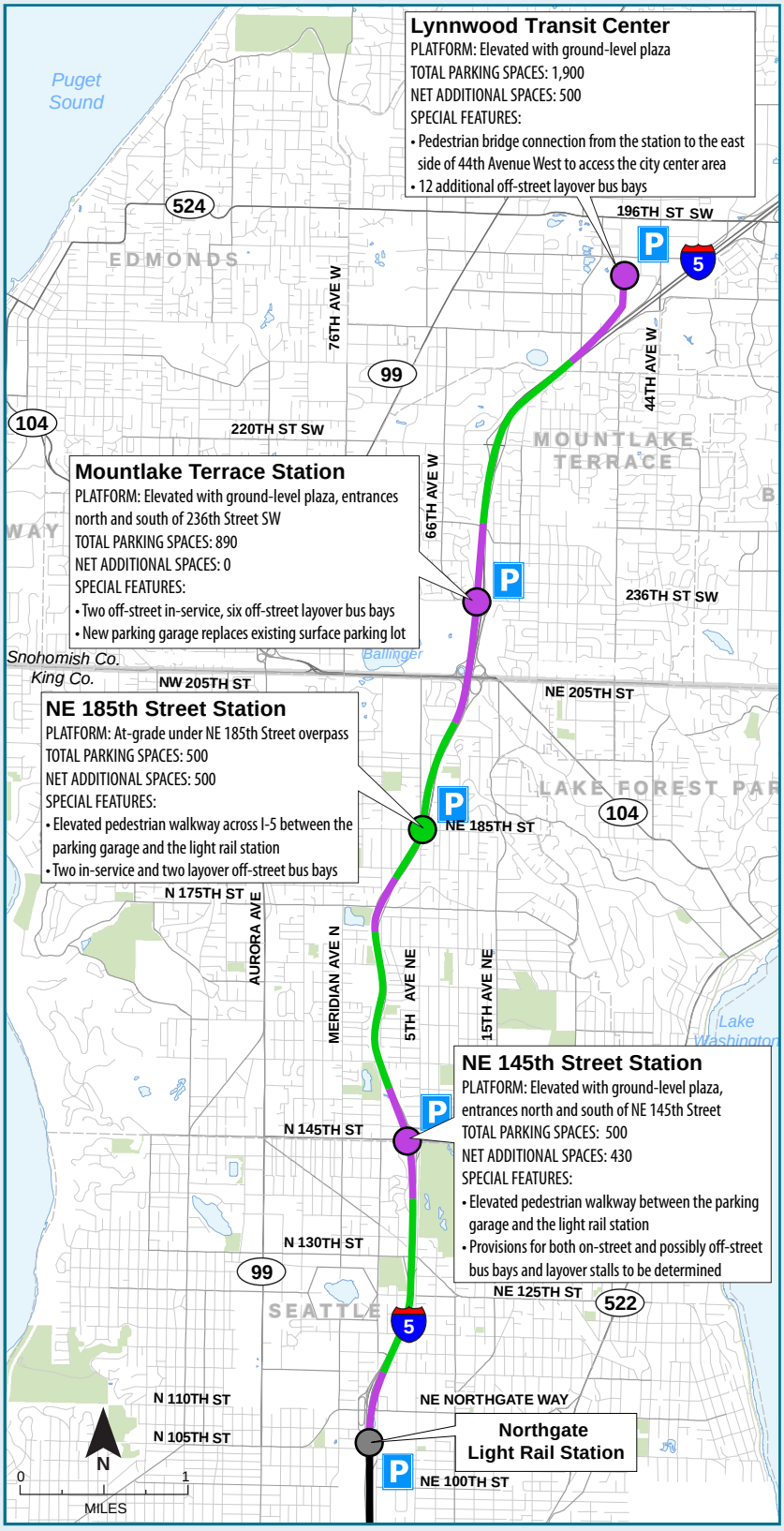


Typical Elevated Cross-section

East Side of I-5



Conceptual. Not to scale.


Lynnwood Transit Center
PLATFORM: Elevated with ground-level plaza
TOTAL PARKING SPACES: 1,900
NET ADDITIONAL SPACES: 500
SPECIAL FEATURES:
• Pedestrian bridge connection from the station to the east side of 44th Avenue West to access the city center area
• 12 additional off-street layover bus bays
Mountlake Terrace Station
PLATFORM: Elevated with ground-level plaza, entrances north and south of 236th Street SW
TOTAL PARKING SPACES: 890
NET ADDITIONAL SPACES: 0
SPECIAL FEATURES:
• Two off-street in-service, six off-street layover bus bays
• New parking garage replaces existing surface parking lot
NE 185th Street Station
PLATFORM: At-grade under NE 185th Street overpass
TOTAL PARKING SPACES: 500
NET ADDITIONAL SPACES: 500
SPECIAL FEATURES:
• Elevated pedestrian walkway across I-5 between the parking garage and the light rail station
• Two in-service and two layover off-street bus bays
NE 145th Street Station
PLATFORM: Elevated with ground-level plaza, entrances north and south of NE 145th Street
TOTAL PARKING SPACES: 500
NET ADDITIONAL SPACES: 430
SPECIAL FEATURES:
• Elevated pedestrian walkway between the parking garage and the light rail station
• Provisions for both on-street and possibly off-street bus bays and layover stalls to be determined
Northgate Light Rail Station
Puget Sound
EDMONDS
MOUNTLAKE TERRACE
LAKE FOREST PARK
SEATTLE
Lake Washington
Snohomish Co.
King Co.
196TH ST SW
220TH ST SW
236TH ST SW
NW 205TH ST
NE 205TH ST
NE 185TH ST
N 175TH ST
N 145TH ST
N 130TH ST
NE 125TH ST
N 110TH ST
N 105TH ST
NE NORTHGATE WAY
NE 100TH ST
76TH AVE W
66TH AVE W
44TH AVE W
AURORA AVE
MERIDIAN AVE N
5TH AVE NE
15TH AVE NE
524
99
104
522
5
N
0
1
MILES

Data Sources: King County, Snohomish County, WSDOT, Sound Transit

Elevated Light Rail
At-Grade Light Rail
Elevated Light Rail Station
At-Grade Light Rail Station
North Link Light Rail
North Link Station
Parking Available at Station

Figure S-8. L1: I-5 Light Rail Alternative

the NE 145th Street and Mountlake Terrace stations that appear to be best located on the east side of the freeway. This results in an alignment at 185th Street with the guideway and passenger platform located on the east side of I-5, but parking located on the west side connected by a pedestrian bridge over the freeway.

The Mountlake Terrace Station is best located either in the median of the freeway or the east side to take advantage of the existing transit infrastructure and minimize new transportation right-of-way requirements. For these reasons, the alignment chosen for the purposes of the Level 2 evaluation runs along the east side of I-5 from Northgate to Mountlake Terrace, crosses the I-5 northbound lanes north of Mountlake Terrace, then runs in the freeway median until it finally crosses the southbound lanes to reach the Lynnwood Transit Center.

Light rail transitions from elevated to at-grade

At-grade light rail at South Trenton Street

In developing the I-5 light rail alignment, ongoing coordination with WSDOT led to a determination that the light rail infrastructure should be located so as to not unduly constrain future modifications to the freeway. In partnership with WSDOT, it was determined that this need could be satisfied by preserving an 84-foot-wide envelope extending from the current freeway centerline to a future eastern edge of pavement along the northbound lanes of I-5 between interchanges.

The conceptual alignment developed is based on preserving this 84-foot-wide envelope between interchanges and assumes an additional 40-foot envelope for light rail operation at freeway level (i.e., at-grade, in retained cut or retained fill), which is generous in comparison to typical width requirements for at-grade rail on level ground (e.g., 30 feet).

S.7.3 L2: SR 99 Mixed Profile Light Rail Alternative

The L2: SR 99 Mixed Profile Light Rail Alternative that advanced to the Level 2 evaluation is similar in concept to the L2: SR 99 Light Rail Alternative assessed as part of the Level 1 evaluation. It includes a combination of elevated and at-grade double-track rail line from Northgate to the Lynnwood Transit Center with four intermediate stations. Figure S-9 provides an overview of the alternative showing the primary alignment and two possible variations—one at the south and one at the north end.

The L2: SR 99 Mixed Profile Light Rail Alternative alignment begins on aerial structure at the Northgate Link Station, continues north and then turns west, crossing over I-5, and

FEATURES AND SERVICE

Profile: Approximately 10.2 miles of elevated and ground-level double-track light rail

Service: Light Rail

Maximum Number of Vehicles: 4

Daily Service: 20 hours

Headways (Peak Hours): 8 minutes

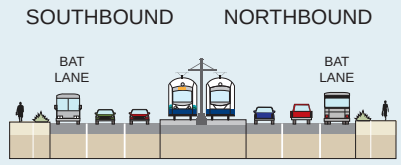
Headways (Off-peak Hours): 10 minutes

Intermediate Stations: 4

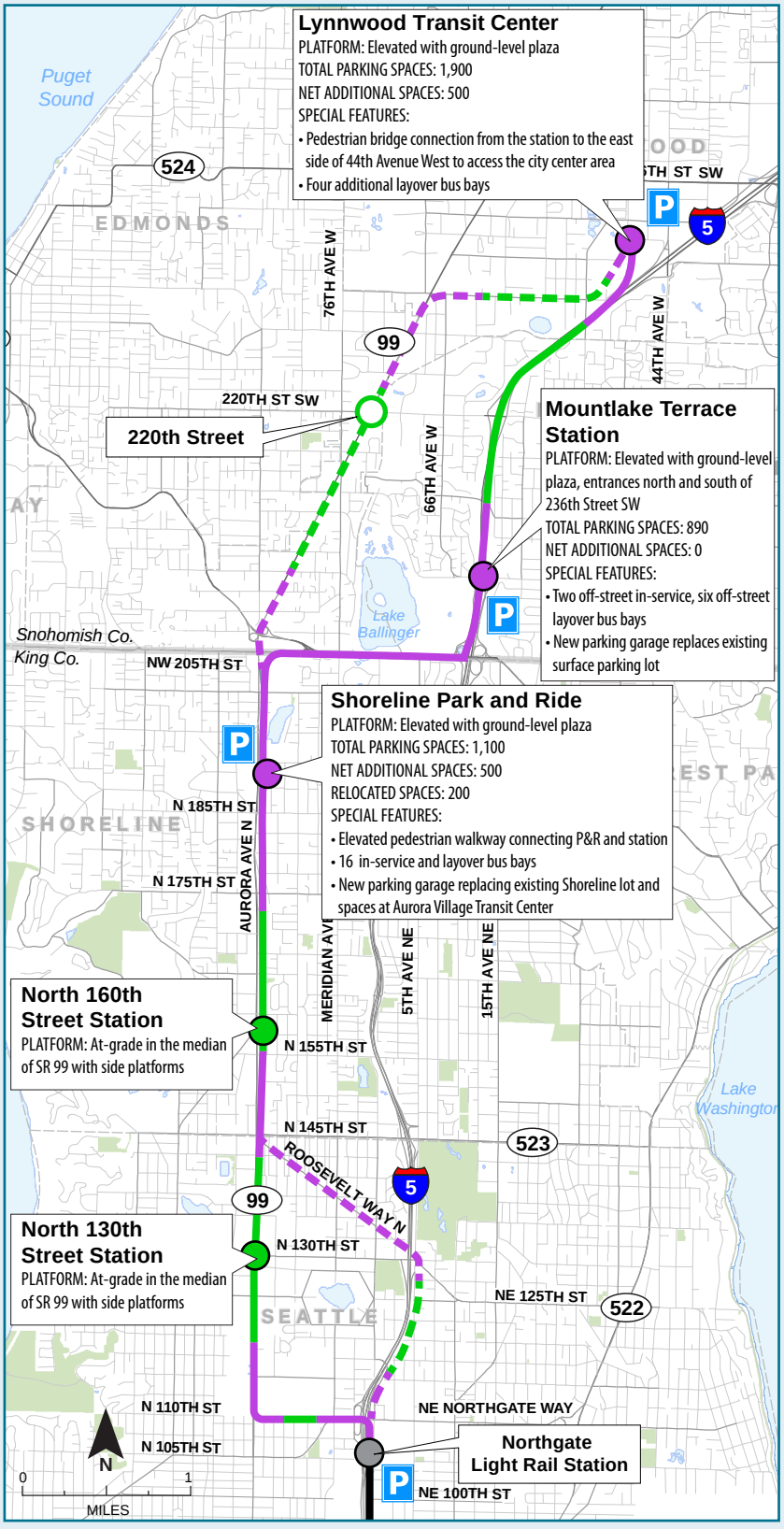
CHANGES TO EXISTING SERVICE

- Community Transit and King County Metro: Routes to Aurora Village Transit Center extended to new Shoreline P&R
- Local north King County Metro routes truncated or extended to light rail stations
- All Sound Transit routes from Snohomish County to Seattle terminate at Lynnwood Transit Center
- Community Transit I-5 commuter routes connecting Edmonds with Seattle terminate at the Mountlake Terrace and Shoreline stations
- King County Metro RapidRide E Line BRT would interface with Community Transit's *Swift* BRT service at Shoreline P&R

SR 99 Typical At-grade Cross-section



Conceptual. Not to scale.



Elevated Light Rail
At-Grade Light Rail
Elevated Light Rail Sub-Alternative
At-Grade Light Rail Sub-Alternative

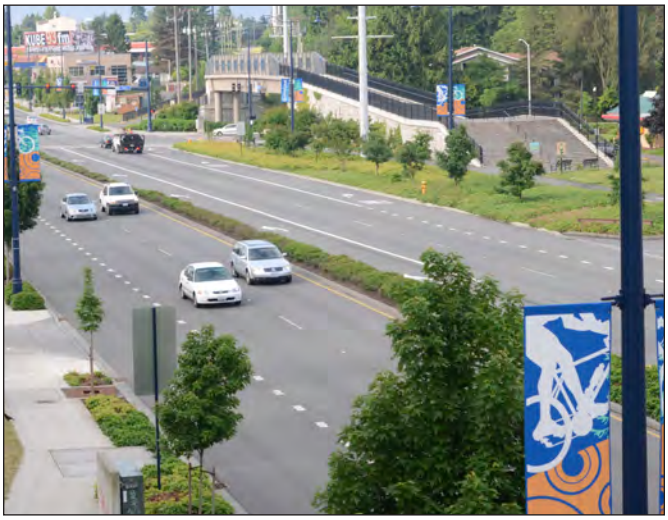
Elevated Light Rail Station
At-Grade Light Rail Station
At-Grade Light Rail Station Sub-Alternative

North Link Light Rail
North Link Station
Parking Available at Station

Figure S-9. L2: SR 99 Mixed Profile Light Rail Alternative

continues along Northgate Way and North 110th Street to SR 99. The aerial alignment would enter the median of SR 99 and continue north, to about North 120th Street, to minimize impacts on the adjacent cemetery. Throughout this section, the existing SR 99 roadway lane configuration would be maintained, with the exception of the center two-way left-turn lane that would be used for the column supports and for left-turn pockets for business access. North of North 120th Street, the alignment would transition to at-grade, and SR 99 would be widened to the east to provide space for the guideway in the median. An at-grade station would be located just north of North 130th Street. The station would be located in the median of SR 99 with side platforms and have a total width of approximately 60 feet and length of approximately 380 feet.

Elevated light rail



SR 99 in Shoreline

North of the 130th Street Station, the at-grade alignment would continue in the center of SR 99 to approximately North 143rd Street, where it would transition to an elevated guideway to cross over the heaviest traffic intersections at North 145th Street and North 155th Street. The alignment would then shift back to at-grade just north of North 155th Street, where a station would be located at North 160th Street. The at-grade station at North 160th Street would be located in the median of SR 99 with side platforms, and have a total width of approximately 60 feet and length of approximately 380 feet.

North of the 160th Street Station, the alignment would continue at-grade in the SR 99 median to approximately North 173rd Street, where it would transition to an elevated structure. The elevated guideway would cross from the median to the west side of SR 99 and continue on the west side of SR 99 to an elevated station at the Shoreline Park-and-Ride (North 192nd Street). The functions now provided by the Aurora Village Transit Center would be relocated to the new Shoreline Park-and-Ride light rail station, creating a new multimodal facility supporting transfers among light rail, *Swift* and RapidRide BRT, park-and-ride lots, and local bus services.

North of the Shoreline Park-and-Ride Station, the elevated alignment would continue along the west side of SR 99. Near the King/Snohomish County line, the aerial structure turns east crossing over SR 99 and continues along the south side of SR 104 until it nears I-5. It then crosses over SR 104 and I-5 and curves north to an elevated station straddling 236th Street SW. Station entrances would be located on both sides of the street to serve the Mountlake Terrace Transit Center, park-and-ride lot and freeway station. From this point northward to the Lynnwood Transit Center, the alignment is the same as the L1: I-5 Light Rail Alternative.

Operating Considerations for At-Grade Light Rail on SR 99

Early in the Level 2 alternatives development process, a decision was made to change from peak-period operation of 4-car trains at 4-minute headways to peak operation at 8-minute headways. This decision was based on analysis of traffic operations along SR 99 and the lessons learned to date as a result of at-grade median light rail operations along Martin Luther King Jr. Way in the city of Seattle.

Early work had indicated some potential for traffic congestion along the at-grade sections of the SR 99 alignment, so work was undertaken to better understand the possible impacts. At-grade light rail operating in the median of SR 99 will require trains to pass through a number of signalized intersections, exposing them to delays that will not occur with a completely grade-separated alignment. At-grade median-running light rail typically operates with traffic signal priority, and trains will need to stop at some signals with some unpredictability. Micro-simulation traffic modeling of SR 99 indicates that, while light rail operations could be fine-tuned to work with 4-minute headways, highly congested and unstable traffic conditions will result. These conditions will lead to a high probability of unpredictable train delays. When combined with the short train headways, schedule recovery from these delays will be difficult.

Another factor in determining the train headways that can be reliably maintained is how this segment fits within the regional rail network.

Figure S-10 illustrates the planned light rail system configuration once extensions are completed east to Overlake in Redmond, south to South 200th Street in SeaTac, and north to Lynnwood. As can be seen in Figure S-10, the system will operate with two lines, one from Lynnwood to South 200th Street and one from Lynnwood to Overlake. Both lines will operate at 8-minute peak-period headways resulting in 4-minute peak headways between the junction at the south end of the Seattle CBD and Lynnwood, and requiring every train operating in the system to traverse the segment between Northgate and Lynnwood. Ridership forecasting indicates that this level of service, at least south of Lynnwood, will be needed to accommodate forecasted demand in the future. As a result, any delays incurred in the segment between Northgate and Lynnwood will affect the operation of the entire light rail system. This problem becomes worse when the system is eventually built north to Everett, south to Tacoma, and east to downtown Redmond.

As a result, it was determined that 4-minute headway operation through signalized intersections along this portion of SR 99 was neither prudent nor practical. Instead, a decision was made to turn back the Overlake trains at Northgate and only continue the South 200th Street trains on to Lynnwood. This increases the headways along SR 99 to a more comfortable 8-minute operation.

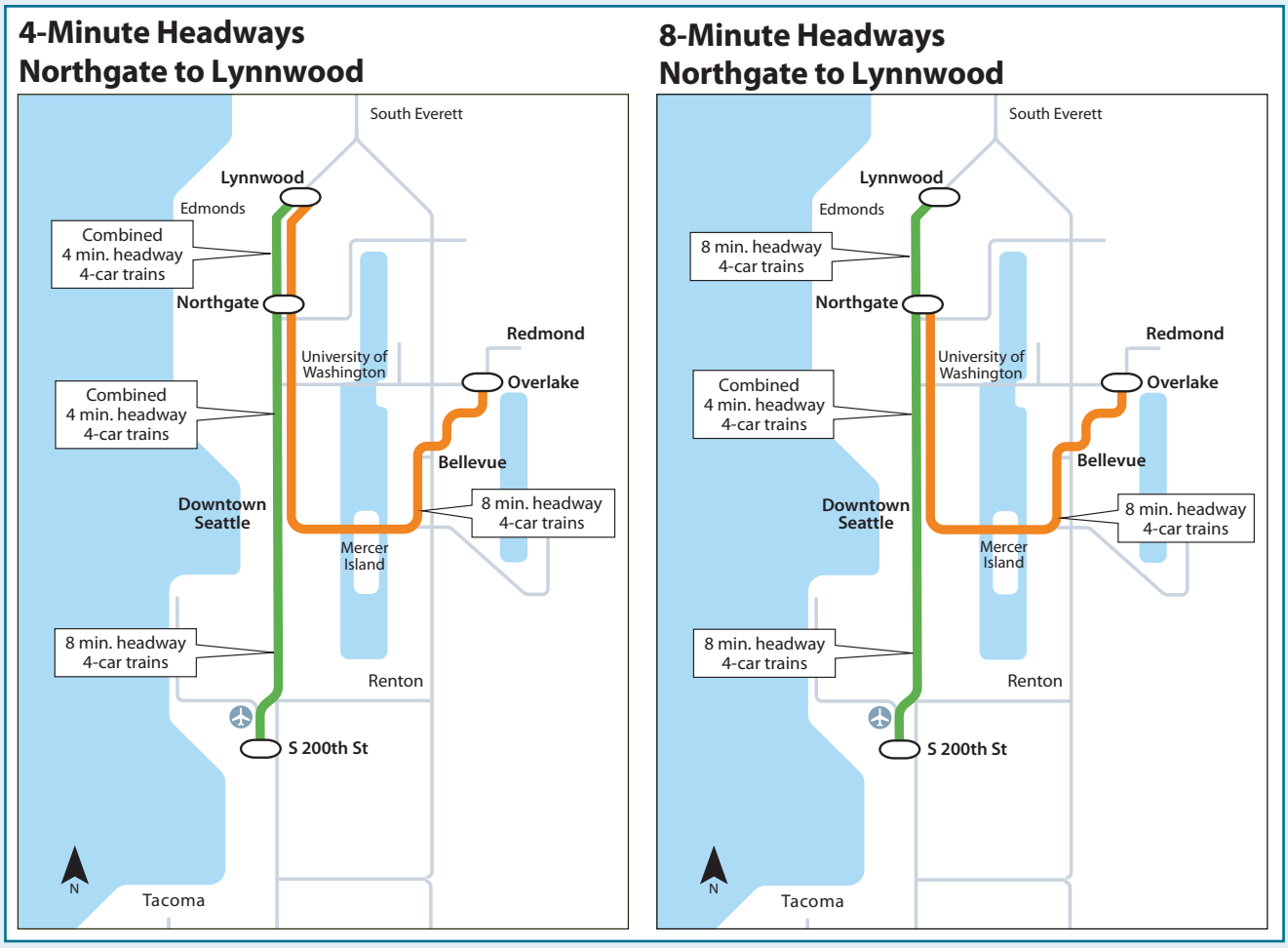


Figure S-10. 4- and 8-Minute System Operating Plans

S.7.4 L3: SR 99 Elevated Light Rail Alternative

The reduction of service levels necessitated in the L2: SR 99 Mixed Profile Light Rail Alternative led to the development of another SR 99 light rail alternative. The L3: SR 99 Elevated Light Rail Alternative evaluated in the Level 2 evaluation has a similar alignment to the L2: SR 99 Mixed Profile Light Rail Alternative with the exception that the entire section along SR 99 would be elevated, as shown in Figure S-11. The differences between the L2 and L3 alternatives occur between approximately North 120th Street and North 175th Street. This fully grade-separated alignment along SR 99 would allow for operations at 4-minute headways during peak periods.

Elevated light rail

The L3 alignment assumes the elevated guideway is located on the west side of SR 99, north of North 120th Street. Alternatively, the alignment could be located either in the median or on the east side of SR 99, though either one would have drawbacks. An elevated guideway in the median of SR 99 would require major roadway reconstruction and widening to accommodate left-turn demand at each signalized intersection.

Median placement would result in traffic impacts because the current two-way left-turn lane would be removed to make space available for column placement. All left turns and U-turns would be consolidated at the signalized intersections, adding to the amount of roadway reconstruction. The cost and complexity of stations would also increase because either a mezzanine level or street level plaza would be required in the median below the passenger platform. For these reasons, a median elevated guideway was not used in this analysis.

Initial evaluation suggests that there are not major differences in the guideway impacts if it is located on the east side instead of the west side. However, both the 160th Street and Shoreline Park-and-Rides appear to be better situated on the west side of SR 99. At 160th Street, existing commercial and high-density residential land uses are located on the west side. The existing Shoreline Park-and-Ride provides a location on the west side that can be redeveloped with an expanded transit center. For these reasons, a primary alignment was chosen for the purposes of the Level 2 evaluation that runs along the west side of SR 99.

S.7.5 B2: Multi-Corridor BRT Alternative

The B2: Multi-Corridor BRT Alternative consists of three BRT lines serving each of the major north-south roadways between the existing

FEATURES AND SERVICE

Profile: Approximately 10.2 miles of primarily elevated light rail with small portions at-grade

Service: Light Rail

Maximum Number of Vehicles: 4

Daily Service: 20 hours

Headways (Peak Hours): 4 minutes

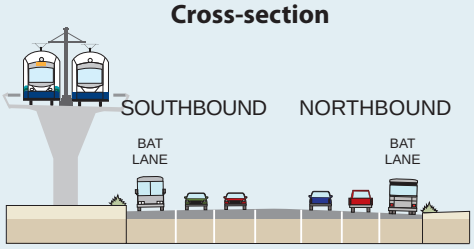
Headways (Off-peak Hours): 10 minutes

Intermediate Stations: 4

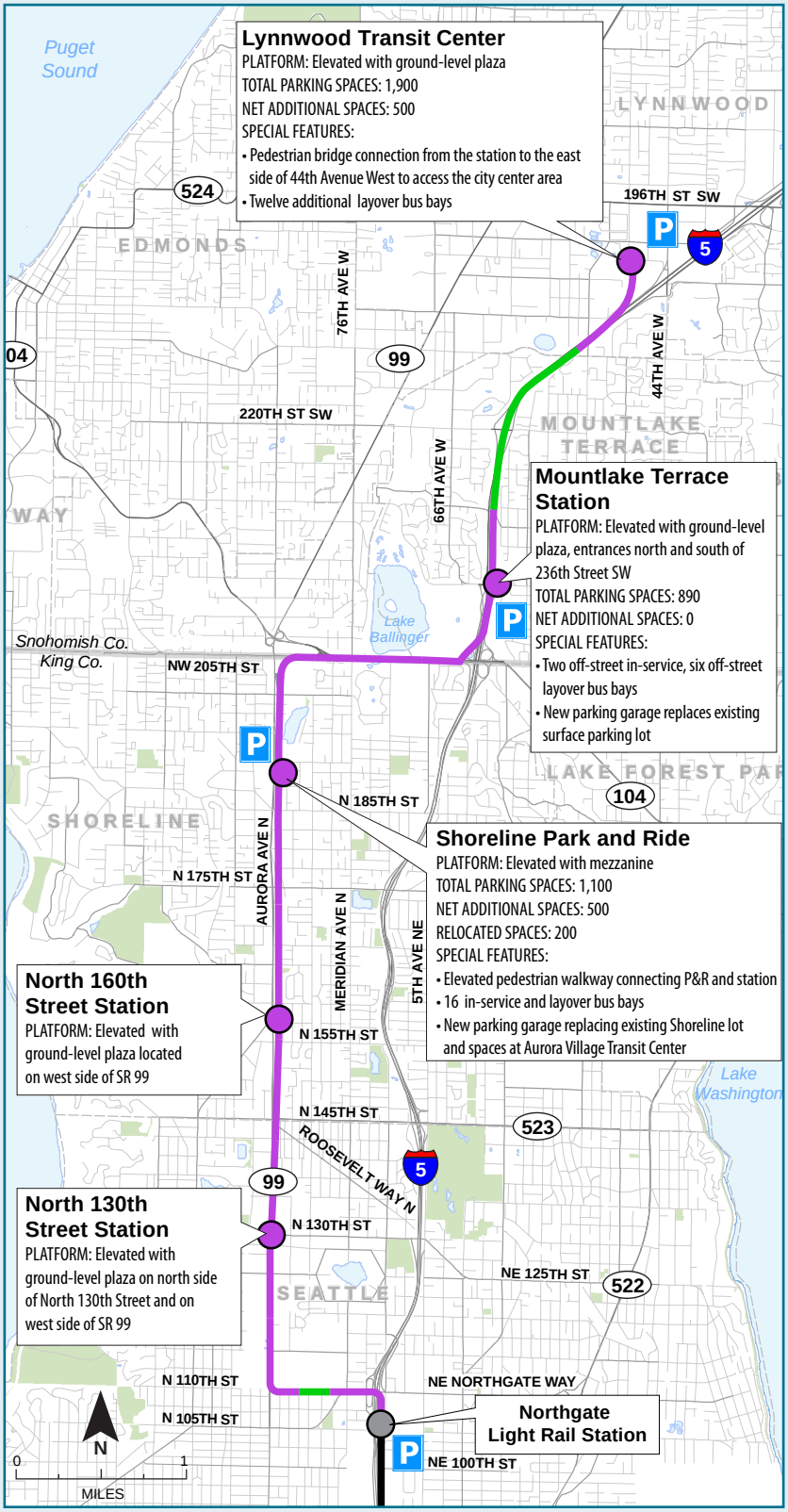
CHANGES TO EXISTING SERVICE

- Community Transit and King County Metro: Routes to Aurora Village Transit Center extended to new Shoreline Transit Center
- Local north King County Metro routes truncated or extended to light rail stations
- Most Sound Transit and Community Transit routes from Snohomish County to Seattle terminate at Lynnwood TC
- Community Transit I-5 commuter routes connecting Edmonds with Seattle terminate at the Mountlake Terrace and Shoreline stations
- King County Metro Route 301 discontinued, and Route 304 truncated at the North 160th Street Station
- King County Metro RapidRide E Line BRT would interface with Community Transit's *Swift* BRT service at Shoreline P&R

SR 99 Typical Elevated Cross-section



Conceptual. Not to scale.



Data Sources: King County, Snohomish County, WSDOT, Sound Transit

Elevated Light Rail
At-Grade Light Rail
Elevated Light Rail Station
North Link Light Rail
North Link Station
Parking Available at Station

Figure S-11. L3: SR 99 Elevated Light Rail Alternative

Northgate and Lynnwood Transit Centers. As shown in Figure S-12, included are an I-5 BRT line that connects the Lynnwood Transit Center to the Northgate Transit Center with an intermediate stop at the Mountlake Terrace Freeway Station; a line serving north Seattle and Shoreline in the SR 99 corridor that connects to I-5 at NE 130th Street; and a line serving the 15th Avenue NE corridor from Mountlake Terrace through Shoreline and north Seattle to an I-5 connection at NE 130th Street. This alternative takes greatest advantage of the BRT infrastructure that already exists in both the SR 99 and I-5 corridors and adds transit-only I-5 HOV lane direct access ramps at NE 130th Street and at the Northgate Station. As with the TSM/Baseline Alternative, existing bus services in the project area focused on the University District and downtown Seattle would remain in place.

Transit signal priority improvements would be provided at all signals along 15th Avenue NE, 200th Street SW, and North 130th Street. Also, because the existing transit signal priority systems on SR 99 in King and Snohomish counties use different technologies, BRT vehicles would be equipped with both types of technology in order to use them. The BRT service mostly would use existing Community Transit *Swift* or King County Metro RapidRide stations. Real-time operating information, CCTV, and off-board fare collection would be incorporated at BRT stations. Five new BRT stations would be required. Four of these stations are in the 15th Avenue NE corridor, with one in the SR 99 corridor, as follows:

- Ballinger Way NE/19th Avenue NE
- NE 175th Street/15th Avenue NE
- NE 145th Street/15th Avenue NE
- NE 125th Street/15th Avenue NE
- SR 99/North 160th Street

The I-5 BRT route would use the existing direct access ramps at Lynnwood, the HOV lanes on I-5, as well as the Mountlake Terrace Freeway Station. New HOV direct access ramps would be constructed to and from the south at North 130th Street to allow the SR 99 and 15th Avenue NE routes to access the I-5 HOV lanes there. New transit-only ramps would be constructed to and from the north near Northgate to serve all three BRT routes. The existing HOV lanes would be used with no modifications except as needed for the new direct access ramps. The existing configuration of I-5 has very little to no median space between Northgate and 236th Street SW. In addition, most of the HOV lanes along this segment of I-5 do not have shoulders that meet current WSDOT standards. Any modifications to the HOV lanes and ramps to the HOV lanes would require widening I-5 to accommodate the proposed ramps and possibly standard shoulder widths.

Lynnwood HOV direct access ramp

Swift station on SR 99

FEATURES AND SERVICE

Profile: Three new high-frequency bus routes along SR 99, I-5 and 15th Avenue NE with ramps connecting with I-5 HOV lanes and transit signal priority improvements

Service: Bus Rapid Transit

Daily Service: 21 hours Monday to Saturday, 20 hours on Sunday

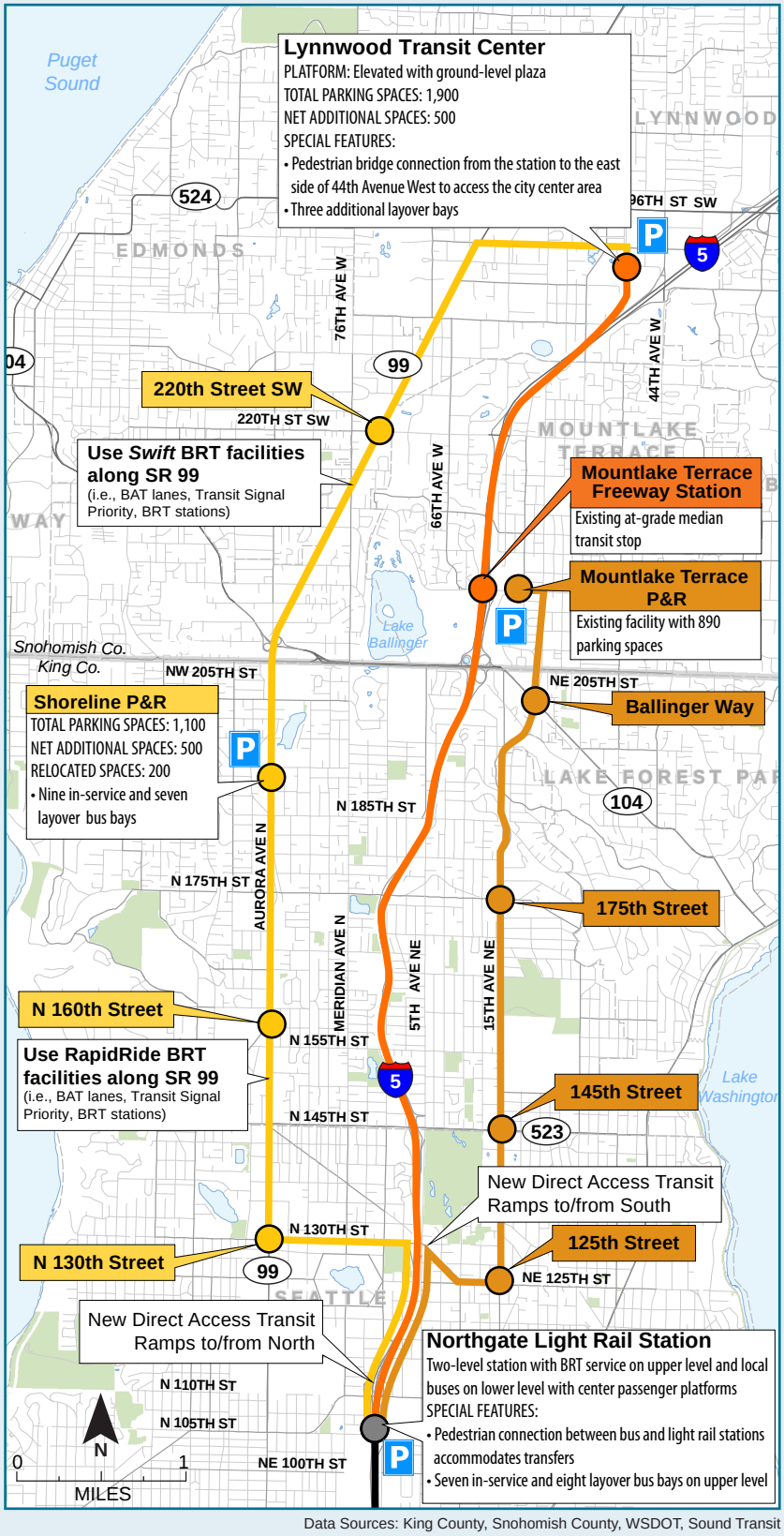
SR 99 Route: Lynnwood Transit Center to Northgate Light Rail Station via 200th Street SW, SR 99/Aurora Avenue North, NE 130th Street, and I-5 with direct access ramps at NE 130th Street and Northgate
Intermediate Stops: 4
Headways (Peak Hours): 10 minutes
Headways (Off-peak Hours): 15 minutes

I-5 Route: Lynnwood Transit Center to Northgate Light Rail Station via I-5
Intermediate Stops: 1
Headways (Peak Hours): 2 minutes
Headways (Off-peak Hours): 10 minutes

15th Avenue NE Route: Mountlake Terrace Transit Center to Northgate Light Rail Station via 236th Street SW, 56th Avenue West/19th Avenue NE, NE 196th Street, 15th Avenue NE, NE 125th Street, Roosevelt Way, NE 130th Street, I-5 with direct access ramps at NE 130th Street and Northgate
Headways (Peak Hours): 15 minutes
Headways (Off-peak Hours): 15 minutes

CHANGES TO EXISTING SERVICE

- Community Transit Route 112 to serve the Mountlake Terrace Transit Center
- King County Metro Routes 301 and 303 replaced by the new SR 99 route
- Community Transit and King County Metro routes serving Aurora Village Transit Center modified to serve Shoreline P&R
- Existing arterial BRT services complemented by the new service



Data Sources: King County, Snohomish County, WSDOT, Sound Transit

Figure S-12. B2: Level 2 Multi-Corridor BRT Alternative

S.8 LEVEL 2 ALTERNATIVES EVALUATION

S.8.1 Summary Evaluation

Table S-1 provides a summary of the Level 2 evaluation findings organized by category of the North Corridor Transit Project's Purpose and Need Statement. The purpose and need is summarized into six broad categories of evaluation measures that were applied to the alternatives. The six categories include those of local importance as well as FTA guidance on recommended factors to be considered in an AA. The findings summary in Table S-1 for the build alternatives shows the change in performance compared to the No Build Alternative for each performance measure. The color shadings run from dark green to light green in tones that indicate the performance of the alternatives going from best performing to worst performing. Red shading indicates where an alternative fails to meet the project's purpose and need related to that specific measure. The TSM/Baseline Alternative is shown in grey because this alternative is developed solely for the purposes of the FTA New Starts criteria comparisons.

Existing Lynnwood Transit Center

S.8.2 Key Findings by Purpose and Need Category

The sections that follow highlight the key findings of the Level 2 evaluation organized by elements of the Purpose and Need Statement.

TRANSPORTATION EFFECTIVENESS

Thirteen criteria were used to assess the transportation performance of the alternatives using 2030 as the design year. The L1: I-5 Light Rail Alternative was the best performing on 8 of the 13 criteria and equal in performance to the next best performing L3: SR 99 Elevated Light Rail Alternative on 4 of the other measures. The L2: SR 99 Mixed Profile Light Rail Alternative was substantially lower on 11 of the 13 criteria compared to the other light rail alternatives. In addition, the L2: SR 99 Mixed Profile Light Rail Alternative is forecasted to be at 95 percent of capacity in 2030, while the fully grade-separated light rail alternatives have substantial capacity to carry additional riders. The B2: Multi-Corridor BRT Alternative was the poorest performing of the build alternatives, generally ranking last on most measures. Findings by key category include the following:

Annual New Riders: This measure counts travelers who previously did not ride transit but are attracted by the project's new facilities and services. Annual new riders are highest for the L1: I-5 Light Rail Alternative, followed by the L3: SR 99 Elevated Light Rail Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative has only half the new riders of the best performing L1: I-5 Light Rail Alternative; the B2: Multi-Corridor BRT Alternative is last with under one quarter of the new riders of the best performing L1: I-5 Light Rail Alternative.

Annual Hours of Travel Time Saved: Travel time savings over the entire transit system as a result of the project is the key measure of user

benefit assessed in the analysis. The pattern of performance of the alternatives is very similar to the performance on the new riders measure. The L1: I-5 Light Rail Alternative saves the most travel time at 4.6 million hours annually, followed by the L3: SR 99 Elevated Light Rail Alternative at 3.8 million hours annually. Savings for the L2: SR 99 Mixed Profile Light Rail Alternative are substantially less at 2.4 million, and the B2: Multi-Corridor BRT Alternative saves the fewest hours at 1 million annually.

Passenger Capacity: Both directional carrying capacity and the share of total capacity that would be filled in the 2030 design year were determined. The latter measure provides information about how much growth—beyond target year ridership—the system could accommodate, and also whether the system would have room for additional riders if it were extended north to Everett, as envisioned in Sound Transit's Long-Range Plan.

Both the L1: I-5 Light Rail Alternative and the L3: SR 99 Elevated Light Rail Alternative have capacity of 8,880 passengers per hour per direction. By 2030 it is estimated that 72 percent of the L1: I-5 Light Rail Alternative's capacity and 62 percent of the L3: SR 99 Elevated Light Rail Alternative's capacity would be required to meet peak hour demand, with the excess capacity available for continued growth in ridership in the project area and for additional demand if the system is extended north to Everett. The L3: SR 99 Elevated Light Rail Alternative has slightly greater excess capacity in the year 2030 than the L1: I-5 Light Rail Alternative since SR 99 forecast ridership is lower but its capacity is the same as I-5.

The L2: SR 99 Mixed Profile Light Rail Alternative has half the capacity of L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative, because it operates on 8-minute rather than 4-minute headways. The factors constraining the L2: SR 99 Mixed Profile Light Rail Alternative headways are the five signalized intersections that would be traversed in this alternative. As a result, the L2: SR 99 Mixed Profile Light Rail Alternative would operate at 95 percent capacity in 2030 with virtually no capacity for ridership growth in the corridor or for extending the system to Everett.

The B2: Multi-Corridor BRT Alternative has the lowest directional capacity of the build alternatives and is estimated to operate at 86 percent of its capacity by 2030. The primary limiting factor for this alternative is the capacity of the expanded Northgate Transit Center to accommodate buses transferring riders to the North Link light rail line.

Travel Time: The speed advantage of the L1: I-5 Light Rail Alternative is reflected in travel time differences for specific individual trips. Light rail in the L1: I-5 Light Rail Alternative cuts peak-period transit travel time between Lynnwood and Northgate in half, compared to the bus in the TSM/Baseline Alternative, and is 20 minutes faster than by automobile. The L3: SR 99 Elevated Light Rail Alternative is the next best performer, but 4 minutes slower than the L1: I-5 Light Rail Alternative. This is

Sound Transit light rail station

Table S-1. Level 2 Alternatives Evaluation Summary

KEY TO RANKING

NOT CONSISTENT with Purpose and Need

LOWER PERFORMING ← → HIGHER PERFORMING

	TSM TSM/Baseline	L1 I-5 Light Rail	L2 SR 99 Mixed Profile Light Rail	L3 SR 99 Elevated Light Rail	B2 Multi-Corridor BRT
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access and Capacity Needs					
2030 Project Daily Riders	21,000 *Daily Riders*	52,000 *Daily Riders*	41,000 *Daily Riders*	48,000 *Daily Riders*	24,000 *Daily Riders*
2030 Annual New Riders	0.64 million *New Riders*	4.5 million *New Riders*	2.5 million *New Riders*	3.9 million *New Riders*	1.1 million *New Riders*
2030 Annual Hours of Travel Time Saved	0.59 million *Hours Saved*	4.6 million *Hours Saved*	2.4 million *Hours Saved*	3.8 million *Hours Saved*	1 million *Hours Saved*
2030 New Weekday Transit Trips to Regional Centers	1,500 *More Trips*	10,400 *More Trips*	5,300 *More Trips*	8,400 *More Trips*	2,500 *More Trips*
Capacity in passengers per hour per direction (pphpd)	1,680 *pphpd*	8,880 *pphpd*	4,440 *pphpd*	8,880 *pphpd*	3,600 *pphpd*
2030 Peak Hour Passenger Demand/Capacity	At capacity	72%	95%	62%	86%
2030 Peak Transit Travel Time: Lynnwood to Northgate	30 minutes	14 minutes	21 minutes	18 minutes	24 minutes
2030 Transit to Auto Travel Time Comparison (Peak Lynnwood to Northgate)	4 minutes *FASTER than Auto*	20 minutes *FASTER than Auto*	13 minutes *FASTER than Auto*	16 minutes *FASTER than Auto*	10 minutes *FASTER than Auto*
2030 Transit to Auto Travel Time Comparison (Peak Lynnwood to Downtown)	6 minutes *SLOWER than Auto*	10 minutes *FASTER than Auto*	3 minutes *FASTER than Auto*	6 minutes *FASTER than Auto*	Similar to Auto
Operations on Non-Exclusive Right-of-Way	23.8 miles	0 miles	0 miles	0 miles	25.8 miles
Signalized Intersections Traversed	30 *Intersections*	0 *Intersections*	5 *Intersections*	0 *Intersections*	50 *Intersections*
Number of Transfers to Reach Major Destinations	1 *Transfer*	0 *Transfers*	0 *Transfers*	0 *Transfers*	1 *Transfer*
2030 Reduction in Weekday VMT	16,900 *Fewer Miles*	191,500 *Fewer Miles*	85,200 *Fewer Miles*	160,700 *Fewer Miles*	33,100 *Fewer Miles*
Purpose and Need: Equitable Community Impacts and Benefits					
Impacts on Affected Communities	Low	Moderate	High	Moderate to High	Low
Transportation Benefits to Affected Communities	Low	High	Moderate	Moderate to High	Low
Purpose and Need: Supportive Land Use and Economic Development Effects					
Access to Regional Growth Centers	Low	High	Moderate	Moderate to High	Low
Station Areas with High TOD Potential	Not Applicable	1 *of 4 Station Areas*	2 *of 5 Station Areas*	2 *of 5 Station Areas*	2 *of 10 Station Areas*

Table S-1. Level 2 Alternatives Evaluation Summary (continued)

KEY TO RANKING

NOT CONSISTENT with Purpose and Need

LOWER PERFORMING ← → HIGHER PERFORMING

	TSM TSM/Baseline	L1 I-5 Light Rail	L2 SR 99 Mixed Profile Light Rail	L3 SR 99 Elevated Light Rail	B2 Multi-Corridor BRT
Purpose and Need: Preservation of a Healthy Environment *At this level of concept development and analysis, measures do not account for possible impact avoidance and mitigation.*					
Ecosystem Effects	Low	Possible High Effects *on Several Sensitive Areas*	Possible High Effects *on Several Sensitive Areas*	Possible High Effects *on Several Sensitive Areas*	Possible Moderate Effects *on Several Sensitive Areas*
Water Resources Effects	Low	Moderate	Low to Moderate	Low to Moderate	Low
Potential Park or Historic Resources Effects, Including Section 4(f) Properties	Low	Low to Moderate	Low to Moderate	Low to Moderate	Low
Daily Reduction in Greenhouse Gas Emissions	Similar to No Build	235 tons	33 tons	223 tons	Similar to No Build
Visual Impacts	Low	Moderate, with Localized High	Moderate, with Localized High	Moderate, with Localized High	Low
Potential for Noise Impacts Requiring Mitigation	Low	Moderate to High	Moderate to High	Moderate to High	Low
New Transportation Right-of-Way Required	5 Acres *0 to 5 Parcels*	22 Acres *140 to 170 Parcels*	44 Acres *320 to 370 Parcels*	40 Acres *200-230 Parcels*	8 Acres *20-30 Parcels*
Traffic Impacts	Minimal	Minor Corridor-wide Improvements	Minor Degradation at SR 99 Intersections	Minimal	Minimal
Pedestrian and Bicycle Travel	Minimal	Improvements Possible Over Time Near Stations	Improvements Possible Over Time Near Stations	Improvements Possible Over Time Near Stations	Minimal
Construction Effects on Transportation System	Low Impacts	Low to Moderate Impacts over Long Duration	High Impacts over Long Duration	Moderate Impacts over Long Duration	High Localized Impacts
Purpose and Need: Cost and Constructability					
Capital Costs *(Millions of Mid-2010 Dollars)*	$200 to $230	$1,420 to $1,640	$1,830 to $2,100	$2,010 to $2,310	$640 to $730
2030 Net Annual Operations and Maintenance Costs *(Millions of Mid-2010 Dollars)*	$17.6	$11.0	$10.4	$14.6	$33.6
Cost per Hour of 2030 User Benefits *(Mid-2010 Dollars)*	$60 to $64	$25 to $28	$61 to $69	$42 to $48	$91 to $99
Incremental Cost per 2030 New Passenger *(Mid-2010 Dollars)*	$55 to $59	$25 to $29	$58 to $67	$41 to $46	$83 to $90
Purpose and Need: Consistency with Sound Transit's Long-Range Vision					
Meets State Definition of HCT	No	Yes	Yes	Yes	No
Consistent with ST Long-Range System Plan	No	Yes	No	Yes	No

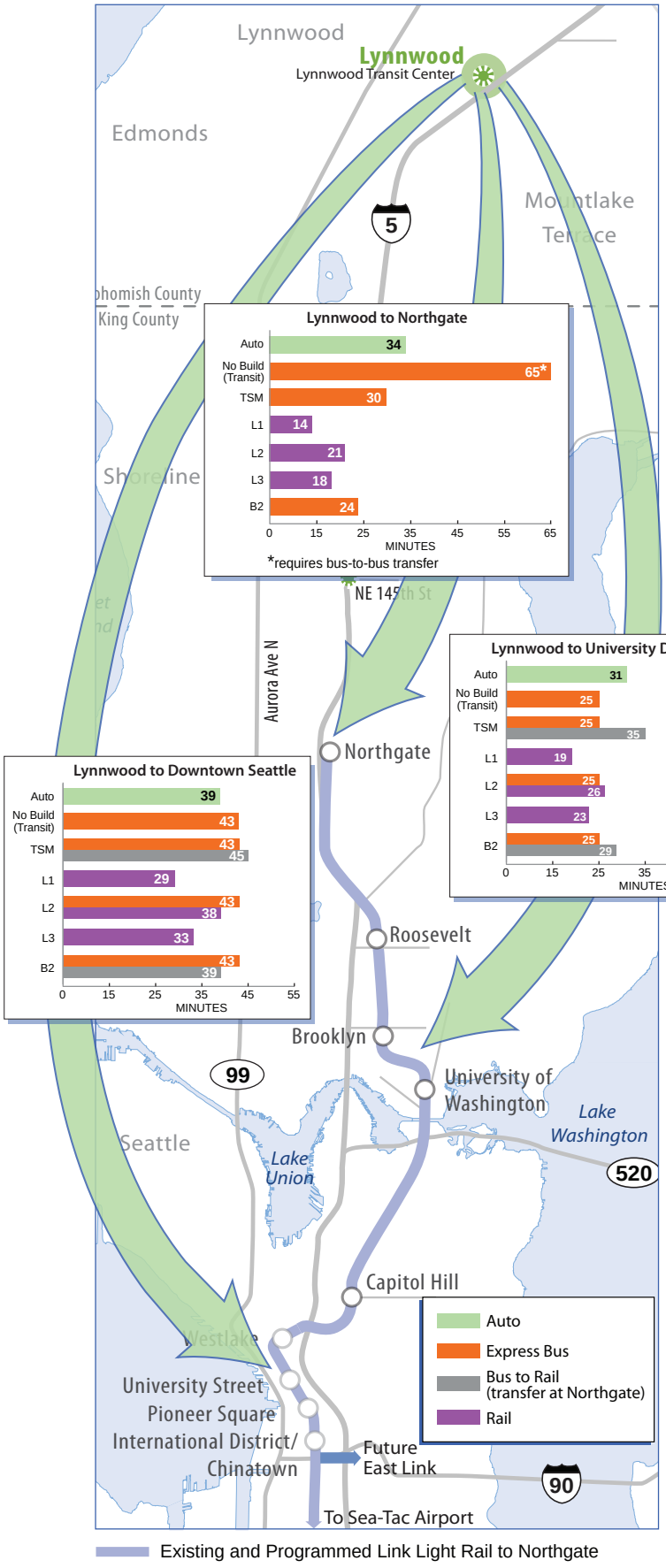


Figure S-13. Year 2030 Auto and Transit AM Peak Hour Travel Times

followed by the L2: SR 99 Mixed Profile Light Rail Alternative, which is 7 minutes slower than light rail in the L1: I-5 Light Rail Alternative. Finally, the bus in the B2: Multi-Corridor BRT Alternative is 10 minutes slower than light rail in the L1: I-5 Light Rail Alternative. Similar results can be seen in travel times between Lynnwood and other regional centers (Figure S-13) where the L1: I-5 Light Rail Alternative has the shortest AM peak hour travel times to both the University District and to downtown Seattle for all alternatives, and is 10 to 12 minutes faster than by automobile.

Measures of Reliability: Miles of operation on non-exclusive right-of-way and the number of at-grade signalized intersections traversed are indicators of potential sources of variable travel delays and resulting unreliable travel times. In many respects the reliability of trip times are as important to riders as actual travel times. On these measures, both the L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative result in the most reliable travel times because both operate on fully exclusive, grade-separated guideways. The L2: SR 99 Mixed Profile Light Rail Alternative would be less reliable because it includes five signalized intersections; the B2: Multi-Corridor BRT Alternative would be the least reliable because of the mixed traffic and HOV lane operations.

Impacts to Existing Transit Service: Both the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail alternatives would replace the existing I-5 Community Transit express bus routes that connect Snohomish County to destinations in Seattle. Because of the slower rail travel times and lower capacity these bus routes would continue to operate on I-5 with the L2: SR 99 Mixed Profile Light Rail Alternative. While light rail on either the I-5 or SR 99 corridor would affect ridership on King County Metro's RapidRide BRT and Community Transit's *Swift* BRT lines operating along SR 99, the SR 99 light rail alternatives would more directly

connect to and compete with those services. Metro's RapidRide E line could experience lower ridership as some riders choose instead to use light rail along SR 99, while Community Transit's *Swift* line could see increased ridership prompted by a direct connection to light rail in Shoreline not provided by light rail running along I-5. The B2: Multi-Corridor BRT Alternative would have impacts to existing transit services similar to the L2: SR 99 Mixed Profile Light Rail Alternative.

EQUITABLE COMMUNITY IMPACTS AND BENEFITS

Community equity looks at potential adverse and beneficial effects on minority and low income populations and communities, generally categorized as "environmental justice communities." Considerations include construction effects, effects on community cohesion and interaction, effects on community facilities, and displacement of residences and businesses. Community benefits include long-term mobility improvements, improvements in travel times, and increased access to employment opportunities.

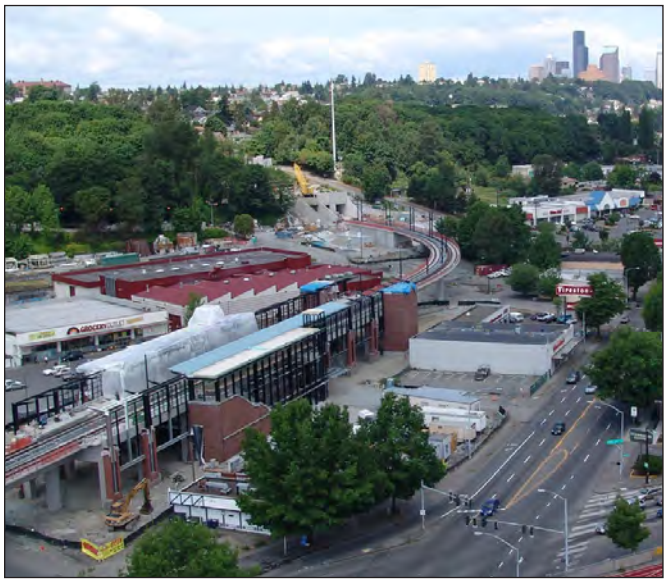
All of the alternatives are located in an area where there are higher percentages of low income and minority populations compared to the rest of King County or Snohomish County. Many of these communities are located in the band between SR 99 and I-5 and extend from Northgate to Lynnwood.

Impacts on affected communities for the B2: Multi-Corridor BRT Alternative are low because new facilities would be limited. Community impacts are moderate for the L1: I-5 Light Rail Alternative, high for the L2: SR 99 Mixed Profile Light Rail Alternative, and moderate to high for the L3: SR 99 Elevated Light Rail Alternative. The L1: I-5 Light Rail Alternative would be constructed along the freeway with fewer potential effects on identified environmental justice communities than either of the SR 99 alternatives, which are built in new right-of-way along a fully developed arterial highway.

Community benefits are higher for the L1: I-5 Light Rail Alternative because it attracts more riders and provides faster service, moderate to high for the L3: SR 99 Elevated Light Rail Alternative, and moderate for the L2: SR 99 Mixed Profile Light Rail Alternative. Community benefits for the B2: Multi-Corridor BRT Alternative are low because it attracts the fewest riders and has the longest travel times.

SUPPORTIVE LAND USE AND ECONOMIC DEVELOPMENT EFFECTS

Two key categories were used to assess land use and economic development performance: access to regional growth centers and station areas with high transit-oriented development (TOD) potential. The first measure addresses the fundamental question of how well each alternative serves the region's adopted growth management and economic development strategies, while the second addresses TOD potential near individual stations within the project area.



Sound Transit light rail station

Access to Regional Growth Centers: The North Corridor Transit Project connects two of the PSRC-designated VISION 2040 regional growth centers (Lynnwood and Northgate) to each other and the other segments of the regional transit system. By this measure, the L1: I-5 Light Rail Alternative performs best, followed by the L3: SR 99 Elevated Light Rail Alternative, the L2: SR 99 Mixed Profile Light Rail Alternative, and finally the B2: Multi-Corridor BRT Alternative. This ranking and relative performance is the result of the quality, as measured by ridership and travel time, and quantity, as measured by capacity, of transportation that is provided.

Transit-Oriented Development Potential: On TOD potential, however, the alternatives are distinguished from each other in a different order. The L2: SR 99 Mixed Profile Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative perform best on this measure because the three stations along SR 99 would provide more opportunities for TOD—where there is already a mix of supportive land uses and density—than would the two stations along I-5 in King County, which are in predominantly single-family dwelling residential neighborhoods. The three light rail alternatives share common stations at Northgate, Mountlake Terrace, and Lynnwood. The B2: Multi-Corridor BRT Alternative also outperforms the L1: I-5 Light Rail Alternative, again because of TOD opportunities that would be created in already existing centers, but it does not rank as high as the SR 99 light rail alternatives (L2 and L3) because of less favorable station locations.

Link light rail near SeaTac

PRESERVATION OF A HEALTHY ENVIRONMENT

Environmental measures focus on the range of effects on the natural environment including water, air, endangered and protected species, and sensitive lands, as well as on the human environment including aesthetics, noise, historic and archaeological resources, property, and existing traffic, transit, pedestrian, and bicycle travel. While there are areas where environmental impacts are anticipated, none of the alternatives is expected to have impacts that would prevent an alternative from being implemented. At this level of concept development and analysis, the environmental measures do not yet reflect the impact of avoidance and mitigation measures that the project would incorporate through further design and environmental efforts. Despite these qualifications, there are some differences in the level of impacts among the alternatives, including:

General Effects: The light rail alternatives would construct the largest amounts of new transportation infrastructure and would require more right-of-way dedicated to transportation in the corridor. This would result in more effects on the environment. The L2: SR 99 Mixed Profile Light Rail Alternative would have the greatest effects followed by the L3: SR 99 Elevated Light Rail Alternative, the L1: I-5 Light Rail Alternative, and then the B2: Multi-Corridor BRT Alternative.

Reduction in Greenhouse Gas Emissions: Reductions in these emissions are a function of the reductions in vehicle miles traveled (VMT) and roadway congestion. While the

forecasts are made at a regional level, several of the alternatives would result in notable reductions in vehicle emissions, providing environmental benefits. The L1: I-5 Light Rail Alternative is forecasted to result in the largest emission reductions, followed by the L3: SR 99 Elevated Light Rail Alternative. Emission reductions for the L2: SR 99 Mixed Profile Light Rail Alternative would be roughly 15 percent of those resulting from the L1: I-5 Light Rail Alternative, while the B2: Multi-Corridor BRT would be similar to the No Build Alternative.

Noise: The light rail alternatives would all be near a large number of noise-sensitive properties and have the potential for noise impacts requiring mitigation. Mitigation for the L2: SR 99 Mixed Profile Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative could be more complex, particularly for the at-grade sections of SR 99. Noise walls would be less effective given the nature of the uses fronting the arterial and the need for frequent driveway and street access. The elevated sections also have the potential to create noise impacts at greater distances. Mitigation would likely involve noise barriers along the elevated sections, which would increase the visual prominence of the guideway.

For the L1: I-5 Light Rail Alternative, there are also a large number of noise-sensitive properties nearby including many single-family homes, but there are more opportunities to avoid impacts through guideway placement (for example, below the existing I-5 cut slopes) or mitigate them with noise walls. As with SR 99, the elevated guideway sections on I-5 would have the potential to cause noise impacts. Potentially affected sensitive receptors would be substantially fewer for the B2: Multi-Corridor BRT Alternative.

Acquisitions and Displacements: The light rail alternatives require continuous construction of new transportation facilities for the length of the alignment, and therefore have the greatest potential impacts. Acquisitions are greatest for the L2: SR 99 Mixed Profile Light Rail Alternative because the existing SR 99 right-of-way is already fully developed and adding light rail requires all new rights-of-way. This is followed by the L3: SR 99 Elevated Light Rail Alternative, which requires slightly less new transportation right-of-way than the L2: SR 99 Mixed Profile Light Rail Alternative because of the smaller ground footprint of the elevated sections. The L1: I-5 Light Rail Alternative, which uses portions of unused I-5 WSDOT right-of-way, requires roughly half the new transportation right-of-way required by the L2: SR 99 Mixed Profile Light Rail Alternative. The B2: Multi-Corridor BRT Alternative requires substantially less new right-of-way in more localized areas than the light rail alternatives.

COST AND CONSTRUCTABILITY

Project affordability was evaluated based on capital costs and annual O&M costs, and on cost-effectiveness measures, including the cost per unit of user benefit and cost per new rider. Key findings on these measures include the following:

Capital Costs (mid-2010 dollars): These vary greatly among the alternatives. With a range of $2,010 to $2,310 million, the

Elevated light rail

L3: SR 99 Elevated Light Rail Alternative would be the most costly to build. The L2: SR 99 Mixed Profile Light Rail Alternative is nearly as costly with an estimated range of $1,830 to $2,100 million. This is followed by the L1: I-5 Light Rail Alternative at a total capital cost of $1,420 to $1,640 million, which is roughly $400 to $500 million less than the range for the L2: SR 99 Mixed Profile Light Rail Alternative and $600 to $700 million less than the L3: SR 99 Elevated Light Rail Alternative. At $640 to $730 million in total, the B2: Multi-Corridor BRT Alternative would be substantially less costly than the rail alternatives, and at $200 to $230 million the TSM/Baseline Alternative would be the least costly to build.

Net Annual O&M Costs in 2030 (mid-2010 dollars): These costs include savings in Sound Transit express regional bus services that would no longer be needed. Both King County Metro and Community Transit also are likely to see operating cost savings as a result of bus services that will no longer be needed with implementation of some of the light rail alternatives. These potential savings, however, are not included in the estimates, as they would accrue to those agencies, not Sound Transit, and will not be available to offset Sound Transit costs.

Northgate Transit Center

In general, the bus alternatives have very high service levels to meet the high travel demand in the North Corridor. This results in very high labor costs for both the TSM/Baseline and B2: Multi-Corridor BRT Alternatives and proportionately high O&M costs compared to the light rail alternatives. The L2: SR 99 Mixed Profile Light Rail Alternative would be the least costly at $10.4 million per year, followed closely by the L1: I-5 Light Rail Alternative at $11.0 million annually, and the L3: SR 99 Elevated Light Rail Alternative at $14.6 million. The TSM/Baseline Alternative would be next at $17.6 million and the B2: Multi-Corridor BRT Alternative would be the most expensive at $33.6 million annually.

Cost per Hour of User Benefits in 2030 (mid-2010 dollars): This is a measure of the annualized capital and year 2030 O&M costs divided by the year 2030 annual hours of travel time savings. While an abstract number, the results are useful for making comparisons among alternatives to determine the relative costs of user benefits—a measure of cost effectiveness. The L1: I-5 Light Rail Alternative is by far the best performing on this measure, at roughly 60 percent of the cost per hour of user benefit of the next best performing L3: SR 99 Elevated Light Rail Alternative. This cost measure for both the L2: SR 99 Mixed Profile Light Rail and TSM/Baseline Alternatives are over twice that for the L1: I-5 Light Rail Alternative. The B2: Multi-Corridor BRT Alternative is the least cost effective based on this measure.

Incremental Cost per New Passenger in 2030 (mid-2010 dollars): This is another measure of cost effectiveness and calculates the annualized capital and year 2030 O&M costs divided by the year 2030 annual new transit riders. The cost per new rider calculation shows a pattern

similar to the travel time savings calculations. The L1: I-5 Light Rail Alternative performs substantially better than the other alternatives, followed by the L3: SR 99 Elevated Light Rail Alternative, the TSM/Baseline Alternative, the L2: SR 99 Mixed Profile Light Rail Alternative, and the B2: Multi-Corridor BRT Alternative in that order.

CONSISTENCY WITH SOUND TRANSIT'S LONG-RANGE PLAN VISION

The final Purpose and Need Statement category addresses whether the project is consistent with Sound Transit's Long-Range Plan, which requires it to meet the state's definition of HCT and be able to eventually extend the service north to Everett. Key findings include the following:

Consistency with State Definition of HCT: As explained in the text box on page S-2, Sound Transit's Washington State enabling legislation defines HCT as being located in exclusive rights-of-way and providing substantially higher levels of service in terms of capacity, speed, and frequency than traditional public transportation systems operating on general purpose roadways. Express buses operating in HOV lanes are recognized as an interim form of HCT service. Under this definition, only the L1: I-5 Light Rail, L2: SR 99 Mixed Profile Light Rail, and L3: SR 99 Elevated Light Rail Alternatives meet the definition of permanent HCT. The bus routes included in the B2: Multi-Corridor BRT Alternative operate in either mixed traffic or in shared HOV or BAT lanes. While the B2: Multi-Corridor BRT Alternative includes the addition of transit only ramp connections at Northgate, its bus service does not operate principally on exclusive rights of way as required by Sound Transit's Washington State enabling legislation.

Consistency with Sound Transit's Long-Range Plan: Only the L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative are consistent with Sound Transit's Long-Range Plan for regional transit because they are the only alternatives that provide capacity for future extensions to Everett. In addition, the L1: I-5 Light Rail Alternative would have substantially shorter travel times between Lynnwood and Northgate compared to any of the other alternatives. The L2: SR 99 Mixed Profile Light Rail Alternative is constrained by the limitations of the at-grade segments and crossings of five major intersections and provides half the capacity of the L1: I-5 Light Rail Alternative. As a result, the L2: SR 99 Mixed Profile Light Rail Alternative is forecasted to be near capacity in 2030 with little capability to absorb growth or the riders added by extending the line north of Lynnwood.

S.8.3 Findings by Alternative

The sections that follow discuss the overall conclusions for each build alternative. The section begins with a brief discussion of the conclusions regarding the TSM/Baseline Alternative, which, while not a build alternative, will be carried forward as the basis for comparison in the New Starts process.

Othello Link light rail station

TSM/BASELINE ALTERNATIVE

The TSM/Baseline Alternative is a requirement of the FTA New Starts planning process and it will serve as the basis for the measures of cost effectiveness that will be used to judge the performance of the build alternatives and ultimately the preferred alternative later in the project development process. This alternative is not very effective in meeting the principal transportation needs identified in the corridor. The TSM/Baseline Alternative is not designed to be consistent with either the definition of HCT or Sound Transit's Long-Range Plan vision of extending the regional transit system north to Everett. It also is the least costly and has the fewest likely potential impacts on the surrounding environment. The TSM/Baseline Alternative has evolved through the AA process, beginning with an early concept of a single new express bus route to now include a comprehensive program of service changes and improvements, along with a number of low-cost transit facility, roadway, and traffic engineering enhancements.

L1: I-5 LIGHT RAIL ALTERNATIVE

The L1: I-5 Light Rail Alternative has evolved from the concept originally developed as the representative light rail alignment during the ST2 system planning work. The initial alternative, based on the ST2 concept, included a fully elevated trackway from Northgate to Lynnwood, running primarily along the east side of I-5, and four new elevated stations. As a result of additional discussions with WSDOT and further concept refinements, it was determined that major sections of the trackway and at least one of the stations could be placed at-grade adjacent to the freeway. The at-grade sections include multiple locations along the east side of I-5 through Seattle and Shoreline and in the median of I-5 in Snohomish County. These changes have the potential to reduce the cost and impacts of this alternative as well as improve its performance.

In general, the L1: I-5 Light Rail Alternative is the best performing in terms of the transportation criteria. Among the light rail alternatives, it is the least costly and has the least potential for impacts on the surrounding environment.

Computer simulation of Northgate Link Light Rail Station

The L1: I-5 Light Rail Alternative is one of two alternatives studied in Level 2 that is capable of supporting Sound Transit's Long-Range Plan vision of extending the regional system north to Everett. The L1: I-5 Light Rail Alternative is consistent with Sound Transit's Long-Range Plan as a result of full operation on exclusive, grade-separated guideway, and conforms to the definition of HCT. In addition, extending light rail from Northgate to Lynnwood in a configuration that allows reliable operation of trains at 4-minute peak-period headways is necessary to support eventual extension of the line north to Everett. At headways longer than 4 minutes in this segment, supplemental express bus service could be required to serve the resulting passenger demand.

Because this alternative involves major infrastructure investment and construction along its entire length, it has the potential for affecting the natural and human environment. Overall, the levels of environmental effects of L1: I-5 Light Rail Alternative are judged to be less than those of the L3: SR 99 Elevated Light Rail Alternative and substantially less than those of the L2: SR 99 Mixed Profile Light Rail Alternative.

From a land use and economic development standpoint, the L1: I-5 Light Rail Alternative does the best at improving access to and from the two PSRC-designated regional growth centers in the project area (Northgate and Lynnwood) by providing the most people-moving capacity and the shortest travel times. However, the transit-oriented development potential for the L1: I-5 Light Rail Alternative at stations between Northgate and Lynnwood is lower than for the intermediate stations served by the L2: SR 99 Mixed Profile Light Rail, L3: SR 99 Elevated Light Rail, and the B2: Multi-Corridor BRT Alternatives. This occurs because the L1: I-5 Light Rail Alternative serves only a single station area (Lynnwood) that has high potential for transit-oriented development compared to two highly-rated station areas (Lynnwood and North 130th Street) for the other alternatives. All alternatives connect to Northgate Station, a station with existing transit oriented land uses and high development potential that could increase with the transit infrastructure investment to Lynnwood.

With a capital cost range of $1,420 to $1,640 million (mid-2010 dollars), it is the least costly of the light rail alternatives considered. From a cost-effectiveness standpoint, the L1: I-5 Light Rail Alternative is by far the best performing, with costs per user benefit and new riders of 60 percent of the next best performing L3: SR 99 Elevated Light Rail Alternative, 40 percent of those for the L2: SR 99 Mixed Profile Light Rail and TSM/Baseline Alternatives, and 30 percent of those for the B2: Multi-Corridor BRT Alternative. Based on an available budget of $1,540 million in Sound Transit's current financial plan, the L1: I-5 Light Rail Alternative is affordable at the low end of its cost range.

At-grade light rail station in median

L2: SR 99 MIXED PROFILE LIGHT RAIL ALTERNATIVE

The L2: SR 99 Mixed Profile Light Rail Alternative is a hybrid based on two earlier concepts studied during the Level 1 evaluation. It combines both at-grade and elevated alignments along portions of SR 99 through the cities of Seattle and Shoreline, then elevated on the south side of SR 104 along the county line between Shoreline and Mountlake Terrace, and finally elevated and at-grade along I-5 to Lynnwood.

Analysis of traffic and train operation through the at-grade intersections along SR 99 concluded that reliable operation of trains at 4-minute headways in both directions was not practical. Instead, 8-minute headways were determined to be the best that could be achieved with partial at-grade operations. This operation requires that one of the two light rail lines serving the Northgate Station be turned back at Northgate and only one of the lines continue on to Lynnwood. As a result of the lower capacity on the SR 99 link and slower speeds, Community Transit express bus operations from Snohomish County to downtown Seattle and the University District would continue to operate on I-5 and would not be truncated at the light rail stations as in the L1: I-5 Light Rail Alternative.

Elevated light rail

With longer headways, lower capacity, and longer travel times, the L2: SR 99 Mixed Profile Light Rail Alternative does not perform as well as the L1: I-5 Light Rail Alternative or L3: SR 99 Elevated Light Rail Alternative from a transportation standpoint. The L2: SR 99 Mixed Profile Light Rail Alternative is consistent with the definition of HCT in the Long-Range Plan, but the 8-minute headways and resulting capacity and travel times do not support Sound Transit's Long-Range Plan vision of eventually extending the regional system north to Everett. Ridership forecasts show that the line to Lynnwood would operate near its practical capacity in 2030 and could not accommodate much growth or the additional riders it would attract if it were extended north to Everett.

Because this alternative involves the longest rail alignment (roughly 2 miles longer with one additional station compared to the L1: I-5 Light Rail Alternative) and the largest amount of new transportation right-of-way, it has the greatest potential for affecting the environment of all the alternatives.

From a land use and economic development perspective, the L2: SR 99 Mixed Profile Light Rail Alternative serves the most station areas with the highest potential for transit-oriented development of all the alternatives. However, its lower capacity and longer travel times mean that it does not perform as well as the L1: I-5 Light Rail Alternative or the L3: SR 99 Elevated Light Rail Alternative from the perspective of access to the PSRC-designated regional growth centers of Northgate and Lynnwood.

The L2: SR 99 Mixed Profile Light Rail Alternative will require lengthy reconstruction of substantial portions of the SR 99 roadway in King County, including those sections through Shoreline which have been rebuilt recently. Placement of the light rail guideway at-grade in the median will require the reconstruction and widening of the entire roadway cross section,

with the greatest effects at major signalized intersections and light rail stations.

With a capital cost range of $1,830 to $2,100 million (mid-2010 dollars), the L2: SR 99 Mixed Profile Light Rail Alternative is the second most costly of the alternatives considered, roughly $400 to $500 million (mid-2010 dollars) more than the L1: I-5 Light Rail Alternative. From a cost-effectiveness standpoint, the L2: SR 99 Mixed Profile Light Rail Alternative is similar to the TSM/Baseline Alternative and better than the B2: Multi Corridor BRT Alternative, but still nearly two and one-half times the cost per hour of user benefit and cost per new rider compared to the best performing L1: I-5 Light Rail Alternative. Based on an available budget of $1,540 million in Sound Transit's current financial plan, the L2: SR 99 Mixed Profile Light Rail Alternative is not within Sound Transit's financial capacity to fund.

L3: SR 99 ELEVATED LIGHT RAIL ALTERNATIVE

The L3: SR 99 Elevated Light Rail Alternative alignment is similar to the L2: SR 99 Mixed Profile Light Rail Alternative except that the at-grade running sections and two at-grade stations along SR 99 of the latter are replaced with elevated facilities running along the west side of SR 99. These changes address the capacity and reliability problems found with the L2: SR 99 Mixed Profile Light Rail Alternative and allow operation of 4-car trains at 4-minute headways similar to the L1: I-5 Light Rail Alternative.

From a transportation standpoint, the L3: SR 99 Elevated Light Rail alternative does not perform as well on most measures as the best performing L1: I-5 Light Rail Alternative. However, the L3: SR 99 Elevated Light Rail Alternative is consistent with and conforms to the definition of HCT and would provide capacity for eventual extension to Everett.

Because this alternative involves major infrastructure investment and construction along its entire length, it has the second greatest potential for affecting the environment. Overall, the levels of effects are judged to be greater than those of the L1: I-5 Light Rail Alternative, but less than those of the L2: SR 99 Mixed Profile Light Rail Alternative.

From a land use and economic development perspective, the L3: SR 99 Elevated Light Rail and L2: SR 99 Mixed Profile Light Rail Alternatives serve the most station areas with the highest potential for transit-oriented development of all the alternatives. However, the slightly longer travel times of the L3: SR 99 Elevated Light Rail Alternative mean it does not perform as well as the L1: I-5 Light Rail Alternative from the perspective of access to the PSRC-designated regional growth centers of Northgate and Lynnwood.

The L3: SR 99 Elevated Light Rail Alternative will require reconstruction of portions of the SR 99 roadway in King County, including those sections through Shoreline which have been rebuilt and widened recently. With the majority of the aerial guideway assumed to be located along the west side of SR 99, construction effects will be concentrated to the west of the existing roadway, and will be substantially less than the full roadway reconstruction associated with the L2: SR 99 Mixed Profile Light Rail Alternative.

With a capital cost range of $2,010 to $2,310 million (mid-2010 dollars), the L3: SR 99 Elevated Light Rail Alternative is the most costly of the alternatives considered, roughly $200 million (mid-2010 dollars) more than the next most costly L2: SR 99 Mixed Profile Light Rail Alternative and $600 to $700 million more than the L1: I-5 Light Rail Alternative. From a cost-effectiveness standpoint, the L3: SR 99 Elevated Light Rail Alternative is the second best performing alternative, but still over 60 percent more costly than the best performing L1: I-5 Light Rail Alternative. Based on an available budget of $1,540 million in Sound Transit's current financial plan, the L3: SR 99

Elevated Light Rail Alternative is well outside Sound Transit's financial capacity to fund.

B2: MULTI-CORRIDOR BRT ALTERNATIVE

Over the course of the AA, different BRT alternatives have been identified, evaluated, and substantially refined and modified to address shortcomings. In general, the B2: Multi-Corridor BRT Alternative's transportation performance is better than the TSM/Baseline Alternative but falls well short of the performance of the light rail alternatives. The B2: Multi-Corridor BRT Alternative is not consistent with the definition of HCT as a result of the long segments of mixed traffic operations of the 15th Avenue NE and SR 99

Swift station

BRT lines. In addition, the use of the I-5 HOV lanes, while meeting the definition of interim HCT services, does not meet the definition of permanent HCT services. The B2: Multi-Corridor BRT Alternative is also not consistent with the Long-Range Plan vision for the extension of service north of Lynnwood to Everett because it is estimated to be near capacity in the year 2030.

The B2: Multi-Corridor BRT Alternative would likely have fewer effects on the environment than any of the rail alternatives because it includes substantially less new infrastructure and transportation right-of-way. Its estimated capital costs are much lower at $640 to $730 million (mid-2010 dollars). On measures of cost effectiveness, however, the B2: Multi-Corridor BRT Alternative performs the worst of all the alternatives, with costs per hour of user benefits and cost per new rider substantially higher than the TSM/Baseline Alternative.

The B2: Multi-Corridor BRT Alternative evolved to its final configuration at the conclusion of the Level 1 evaluation based on the analysis of a number of BRT concepts. The key elements of this alternative were to provide enhanced bus service and associated transit infrastructure investments along three parallel alignments (SR 99, I-5, and 15th Avenue NE) within the larger North Corridor. This proved more effective from both a cost and rider benefit standpoint than focusing all BRT service and infrastructure in the I-5 alignment. This conclusion was based in part on the difficulties of providing fast and highly reliable bus service using the existing I-5 HOV lanes and the very high cost of building new direct access ramps to and from these lanes.

After much work at the end of the Level 2 evaluation, it is apparent that not much more can be done to address the failings of the BRT options to meet the project's purpose and need in three critical areas—transportation effectiveness, cost and constructability, and consistency with Sound Transit's Long-Range Plan vision. From a transportation effectiveness

Sound Transit Regional Express

standpoint, the B2: Multi-Corridor BRT Alternative falls well short of the performance of the rail alternatives on every performance measure and is only marginally better than the TSM/Baseline Alternative on many. The weak transportation benefits, combined with the relatively large capital and O&M costs, result in very unfavorable cost-effectiveness performance for the B2: Multi-Corridor BRT Alternative, falling well short of the performance of the TSM/Baseline Alternative.

S.9 TRADE-OFFS AMONG THE ALTERNATIVES

Figure S-14 shows the alternatives screening and evaluation process. The AA process started with the identification of both bus and light rail concepts and numerous alignment and corridor variations, progressed through a pre-screening step and concept screening step, and then moved through two levels of detailed evaluation. The AA process identified a single BRT alternative and three primary light rail alternatives that showed the greatest promise for meeting the project's purpose and need. These alternatives were studied in greater detail as part of the Level 2 evaluation, resulting in the following conclusions about the performance and trade-offs among alternatives:

Mode: Light rail transit is the only mode that can satisfy the North Corridor Transit Project's purpose and need related to transportation effectiveness in meeting the corridor's mobility, access, and capacity needs, as well as consistency with Sound Transit's Long-Range vision.

Grade Separation: Fully grade-separated light rail alternatives (L1 and L3) markedly outperform the alternative that includes at-grade crossings (L2) in satisfying purpose and need related to transportation effectiveness in meeting the corridor's mobility, access, and capacity needs. Moreover, fully grade-separated light rail alternatives are the only alternatives that meet purpose and need related to consistency with Sound Transit's Long-Range Plan. The L2: SR 99 Mixed Profile Light Rail Alternative is not consistent with the project's purpose and need in this regard, since the longer 8-minute headways of this alternative provide little capacity for ridership growth beyond the year 2030 or for expansion northward to Everett.

Transportation Performance: From a transportation effectiveness standpoint, the L1: I-5 Light Rail Alternative is the best performing of all the alternatives when it comes to ridership, travel times, overall user benefits, capacity, and reliability.

Balance of Benefits: The fully grade-separated light rail alignments along I-5 and SR 99 also provide the best balance of transportation benefits while accomplishing other elements of the North Corridor Transit Project's purpose and need. These elements include community equity, supportive land use and economic development effects, and consistency with Sound Transit's Long-Range Plan.

Costs and Cost Effectiveness: The L1: I-5 Light Rail Alternative is substantially less costly than a fully grade-separated alignment on SR 99 (L3). In addition, the transportation performance of the L1: I-5 Light Rail Alternative is superior or equal to the L3: SR 99 Elevated Light Rail Alternative on all measures. As a result, the L1: I-5 Light Rail Alternative's cost effectiveness is substantially better than the L3: SR 99 Elevated Light Rail Alternative on measures related to the cost per new rider and cost per unit of user benefit.

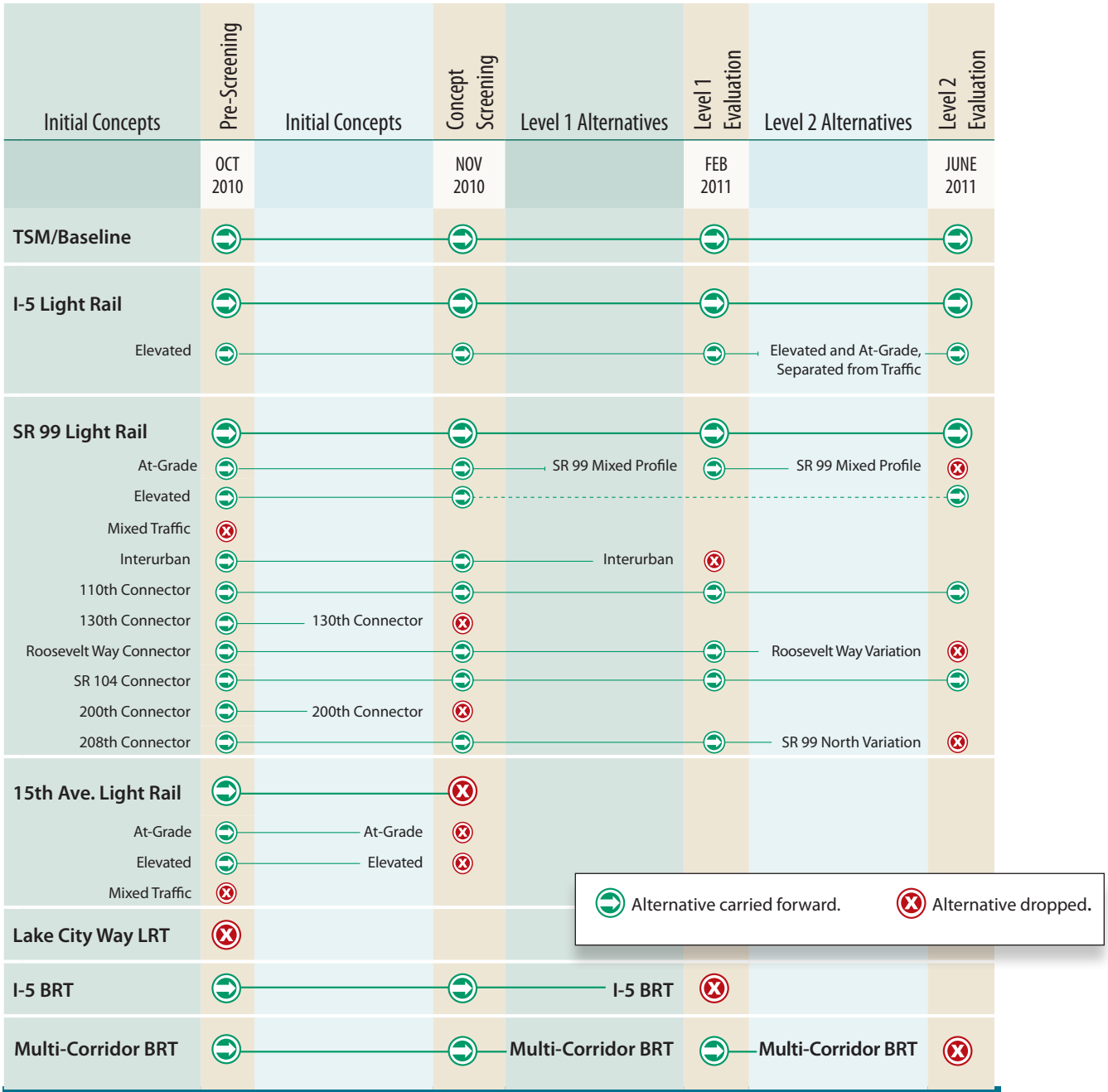


Figure S-14. Summary of Alternatives Development, Screening, and Evaluation Process

Affordability: Given the $1,540 million (mid-2010 dollars) currently budgeted for North Corridor Transit Project capital costs in Sound Transit's current financial plan, the SR 99 light rail alternatives (L2 and L3) would both be well outside of Sound Transit's existing financial capacity to fund. The L1: I-5 Light Rail Alternative, however, is affordable within that capacity at the low end of its capital cost range.

Economic Development and Land Use: The SR 99 light rail alternatives have greater economic development and TOD potential in the intermediate station areas in the cities of Seattle and Shoreline than does the L1: I-5 Light Rail Alternative, although the latter alternative does better at serving the primary designated regional growth centers in the corridor of Northgate and Lynnwood.

Risks: The L1: I-5 Light Rail Alternative takes advantage of portions of the I-5 right-of-way that are currently not developed in roadway. While WSDOT has indicated that this right-of-way can be made available to Sound Transit for light rail development, until a specific agreement is reached, this is an area of cost and impact risk. Use of the I-5 right-of-way reduces the likely level of potential environmental effects and risk compared to the SR 99 light rail alternatives, which require roughly twice the amount of new transportation right-of-way.

S.10 NEXT STEPS

Based on the results of the North Corridor Transit Project AA, Sound Transit plans to move forward in developing a major transit capital investment in the corridor between Northgate and Lynnwood. The next step is to share the findings of the AA with the public and elicit agency and public feedback through formal environmental scoping. Following scoping, Sound Transit will decide which alternatives to carry forward for further development, analysis, and environmental review under NEPA and SEPA guidance, including the possible identification of a Locally Preferred Alternative (LPA). Sound Transit plans to make these decisions late this year after consideration of public and agency scoping comments.

The potential impacts of the North Corridor Transit Project are such that a NEPA/SEPA Environmental Impact Statement (EIS) will be prepared. Work on the Draft EIS will start early in 2012 and take approximately 12-18 months to complete. The No Build Alternative will be carried forward to provide the basis for comparison of the impacts and benefits of the build alternative(s). The TSM/Baseline Alternative, however, will move forward in its current form only as the basis for the FTA New Starts comparisons, but not as a build alternative. If Sound Transit does not identify an LPA prior to the start of the Draft EIS then multiple build alternatives will be developed further and studied as part of the Draft EIS, with the LPA choice deferred to the end of the Draft EIS. Following public review and comment on the Draft EIS, Sound Transit will complete preliminary engineering for the LPA and develop a Final EIS. Based on the Final EIS, the Sound Transit Board will select the project to be built and operated, FTA will issue a Record of Decision (ROD), and the project will then move into final design, followed by construction, start-up and testing and ultimately operation. Service is planned to begin in 2023.

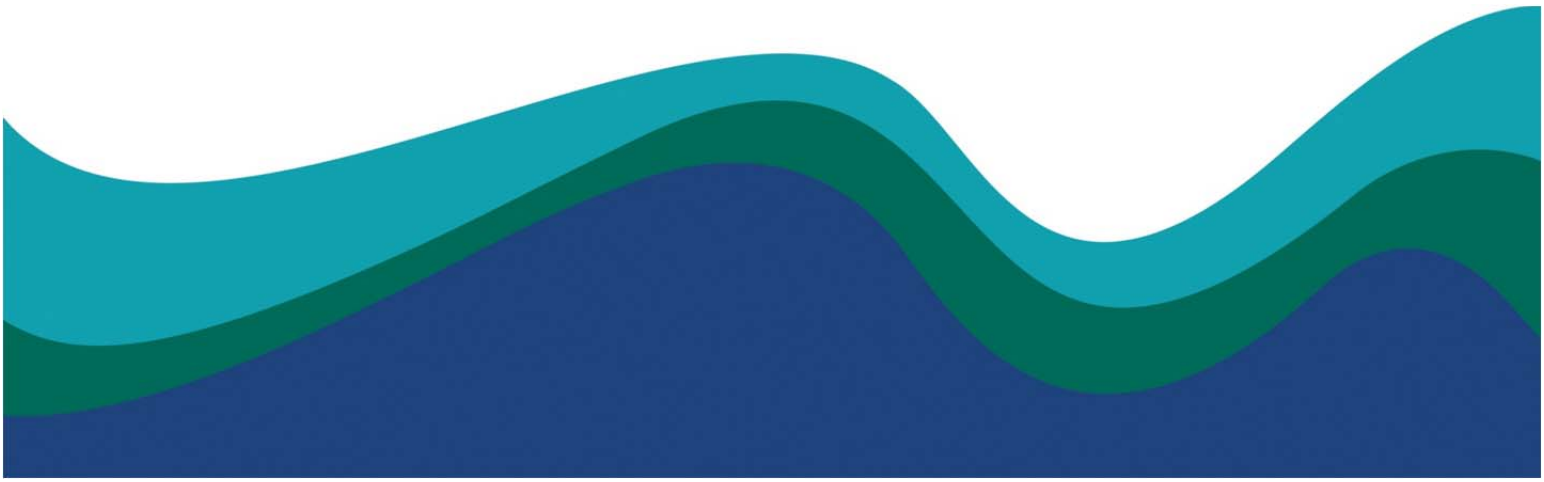
1 INTRODUCTION

1.1 CONTEXT OF THE ALTERNATIVES ANALYSIS

The Central Puget Sound Regional Transit Authority (Sound Transit) intends to expand regional transit service in the North Corridor, connecting the existing regional transit system from the planned interim terminus of Link light rail in the Northgate neighborhood of Seattle to the city of Lynnwood in southern Snohomish County. Approved by voters as part of the Sound Transit 2 (ST2) Plan in 2008 (Sound Transit 2007a), the North Corridor Transit Project would connect to and build on the Link light rail line that opened for service between downtown Seattle and Sea-Tac Airport in 2009, and would extend northward to serve north Seattle, Shoreline, Mountlake Terrace, and the city of Lynnwood in southern Snohomish County. Construction is currently underway on a light rail extension to the University of Washington scheduled to open in 2016, followed by service to Northgate targeted in 2021. Voter-approved additions over the next few years will bring 36 new miles of service to the north, south, and east, creating a 55-mile light rail system serving the region.

The North Corridor project connecting Northgate to Lynnwood is an incremental step in the implementation of the Puget Sound Regional Council's (PSRC's) VISION 2040 (PSRC 2009) and the Sound Transit 2005 *Regional Transit Long-Range Plan* (Sound Transit 2005a), both of which call for the eventual extension of high capacity transit (HCT) service north to Everett. Figure 1-1 shows the Regional Transit System plan map adopted by Sound Transit in 2008 as well as the North Corridor.

The North Corridor Transit Project relies on receiving federal assistance to complete the project. In accordance with federal regulations and guidelines for fixed guideway projects that seek New Starts grant funds from the Federal Transit Administration (FTA), Sound Transit has completed an Alternatives Analysis (AA) to evaluate a range of potential alternatives for addressing mobility needs in the North Corridor, including routes, stations, and operating features for the North Corridor Transit Project. This is the first step in the FTA's New Starts Project Planning and Development process.



1.2 PURPOSE AND OVERVIEW OF THE ALTERNATIVES ANALYSIS

The purpose of the AA is to define the transportation needs in the corridor, identify reasonable alternatives that would address the identified needs of the corridor, and provide information to help Sound Transit identify a preferred transit mode and route for implementation. While an AA is a local process, FTA provides general guidelines for how to conduct it. These include four major steps: study initiation; development and refinement of alternatives and technical methodologies; analysis and evaluation; and identification of the Locally Preferred Alternative (LPA) or proposed action.

During the AA study initiation phase, the roles and responsibilities of participating agencies are established, issues to be addressed in the study are defined, and the availability of data and models for addressing these issues is determined. The study initiation phase also develops a detailed work plan, a problem statement and purpose and need, evaluation measures to guide the subsequent analysis, and a conceptual definition of alternatives to be included in the study. For the North Corridor Transit Project, these steps are documented in the *Revised Draft Alternatives Analysis Initiation Report*, May 2010. Chapter 2: Purpose and Need documents the problem statement and purpose and need.

Once the AA study has been initiated, the next step is to further refine the alternatives and analysis methods. This step is designed to ensure that all participants in the process are in general agreement with the alternatives and analysis methods before the alternatives are further developed and evaluated in greater detail. This step often includes a preliminary analysis to screen out those alternatives that clearly cannot satisfy the purpose and need or show the least amount of promise. For the North Corridor Transit Project, these steps are summarized in Chapter 3: Development and Screening of Alternatives and documented in more detail in the *Final Level 1 Alternatives Analysis and Evaluation Report*, February 2011.

The third step includes the more detailed development of the most promising alternatives followed by the analysis and evaluation of these alternatives. This step constitutes the main work of the AA study. This step includes applying the methodologies developed for each of the study's evaluation measures to assess the transportation, environmental, and financial impacts of each alternative. The third step in the AA study is documented in Chapter 4: Detailed Definition of Alternatives, Chapter 5: Analysis of Alternatives, and Chapter 7: Comparative Evaluation of Alternatives.

Source: Sound Transit

Figure 1-1. Sound Transit 2 Regional Transit System Plan Map and North Corridor

Once the comparative analysis is completed and reviewed and a recommendation is reached, the next step is the preparation of a Draft Environmental Impact Statement (EIS). Two approaches are possible at this stage depending on the timing of the identification of a locally preferred transit mode and alignment. This action, known as the identification of a Locally Preferred Alternative (LPA), can occur prior to the start of the DEIS or following the public review and comment on the DEIS.

Following both federal and local review of the findings and conclusions of the AA, Sound Transit plans to decide on which alternatives to carry forward for further development and study in the NEPA and SEPA environmental process, including the possible identification of a Locally Preferred Alternative (LPA). Chapter 8: Conclusions and Next Steps summarizes the findings of the AA and provides an overview of the next steps in the New Starts project development process.

1.3 RELATIONSHIP TO THE ENVIRONMENTAL PROCESS

The North Corridor Transit Project AA was conducted with a public and agency outreach program supporting NEPA and Washington's State Environmental Policy Act (SEPA) requirements. Chapter 6: Public and Agency Involvement and Coordination documents those efforts undertaken as part of this AA study. Because the project has the potential for causing environmental impacts, the project will require an EIS. However, because the AA is establishing many key elements of the project, including its purpose and need and the range of EIS alternatives to be considered, Sound Transit and FTA decided to conduct early scoping at the start of the AA in 2010. This optional step in the state and federal environmental review processes allowed Sound Transit and FTA to receive comments from the public, agencies, and other stakeholders as they developed the project alternatives that would lead to more detailed engineering and environmental study.

The early scoping process for the North Corridor Transit Project occurred in September and October 2010, and included public and agency meetings. This information was used to refine the purpose and need and define conceptual alternatives including alignments and modes. Based on the recommendations of the AA, Sound Transit and FTA will initiate project-level environmental scoping, announcing the type of environmental document they will prepare and offer further opportunities for public and agency involvement.

1.4 ORGANIZATION OF THE REPORT

This report presents findings from three levels of screening, including initial concept screening, Level 1 evaluation, and Level 2 evaluation. After the Summary, the report is organized into eight chapters:

- Summary
- Chapter 1: Introduction
- Chapter 2: Purpose and Need
- Chapter 3: Development and Screening of Alternatives
- Chapter 4: Detailed Definition of Level 2 Alternatives
- Chapter 5: Analysis of Alternatives
- Chapter 6: Public and Agency Involvement and Coordination
- Chapter 7: Comparative Evaluation of Alternatives
- Chapter 8: Conclusions and Next Steps

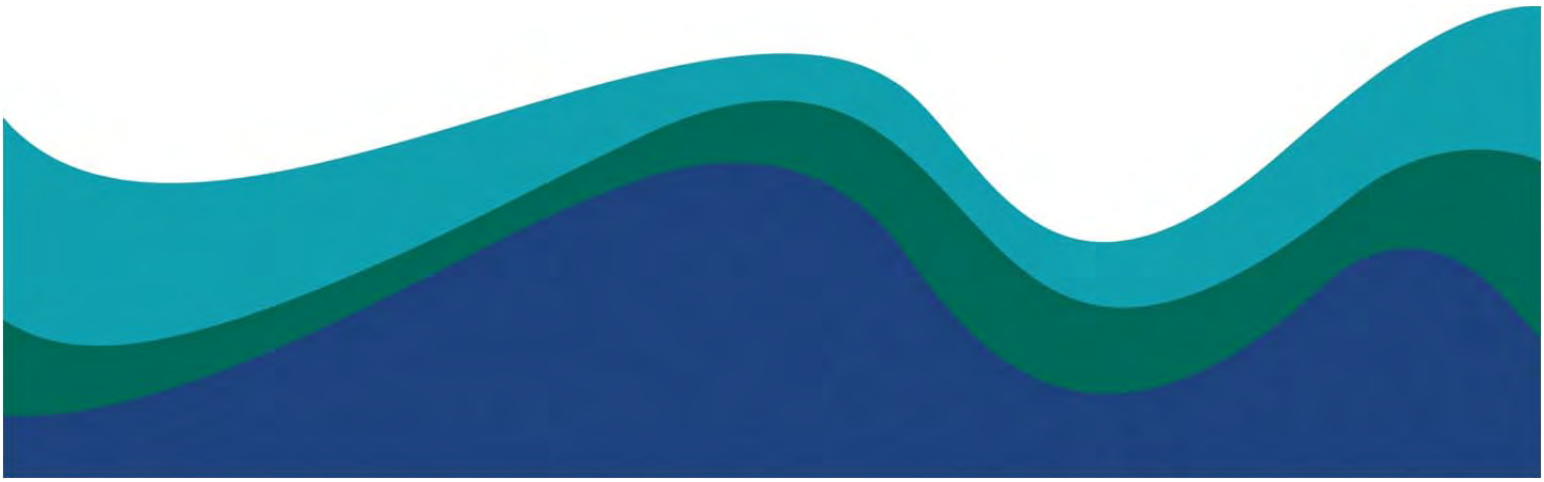
2 PURPOSE AND NEED

A purpose and need statement is required under NEPA, describing the reasons why the project is being proposed. The purpose and need statement is used to guide decisions about alternatives based on their ability to satisfy the purpose and need for the project, not only during the AA phase, but through the overall environmental process.

2.1 PURPOSE AND NEED STATEMENT

Sound Transit is proposing the North Corridor project to improve regional transit service from Seattle north into Snohomish County in one of the region's most heavily traveled corridors linking the cities of Tacoma, Seattle, and Everett. The project is in response to a public vote in November 2008 authorizing the funding for the North Corridor project as part of the ST2 Plan. Sound Transit's legislative mandate is to improve public transportation and mobility in the central Puget Sound region by developing an HCT system operating principally on exclusive rights-of-way and providing a substantially higher level of passenger capacity, speed, and service frequency than traditional public transportation systems operating principally in general purpose roadways (State High-Capacity Transportation Systems Act Chapter 81.104 of the Revised Code of Washington [RCW]). The corridor currently has express bus service operating in the Interstate 5 (I-5) high-occupancy vehicle (HOV) lanes utilizing HOV direct access and freeway transit station facilities at Lynnwood and Mountlake Terrace, respectively. This service, however, already has reliability problems because the HOV system is incomplete and is highly congested during peak periods; as a result, the express bus system does not adequately meet the growing transit needs of the corridor. In addition, the highest demand for the service is during the congested peak commute periods as travelers from residential areas in King and Snohomish counties travel south to major job centers in Seattle and east King County, or north toward Everett.

To guide decision-making during the AA phase and through the project's state and federal environmental processes, Sound Transit has developed the following statement of the project's Purpose and Need.



2.1.1 The Purpose of the North Corridor Transit Project

The purpose of the project is to improve regional mass transit service from Seattle north into Snohomish County by:

1. Providing reliable, rapid, and efficient two-way, peak and off-peak transit service of sufficient capacity to meet the existing and projected demand between the communities and activity centers located in the North Corridor and the other urban centers in the Central Puget Sound area;
2. Providing a mobility alternative to travel on congested roadways, and improving connections to the regional multimodal transportation system;
3. Supporting North Corridor communities' and the region's adopted land use, transportation and economic development vision, which promotes the well-being of people and communities, ensures economic vitality and preserves a healthy environment; and
4. Supporting the long-range vision, goals, and objectives for transit service established by Sound Transit's Long-Range Plan for high quality regional transit service connecting major activity centers in King, Pierce and Snohomish counties, including a connection between Seattle and Everett.

2.1.2 The Need for the Project

The project is needed to:

- Meet the rapidly growing needs of the corridor and the region's future residents and workers by increasing mobility, access, and transportation capacity to and from regional growth and activity centers in the North Corridor and the rest of the region, as called for in the region's adopted plans, including the PSRC's VISION 2040 and *Transportation 2040*, as well as related county and city comprehensive plans.
- Address the problems of increasing and unreliable travel times for transit users in the North Corridor, who are now dependent on the corridor's highly congested roadway and HOV systems.
- Address overcrowding facing current and future North Corridor transit riders due to insufficient capacity of the current transit system.
- Provide an alternative to automobile trips on I-5 and State Route (SR) 99, the two primary highways serving the corridor, which are unreliable and over capacity throughout significant portions of the day.
- Implement the long-range vision for HCT service established by Sound Transit's Long-Range Plan, with a regional transit investment that supports economic vitality, preserves the environment, preserves communities, and allows for the future extension of HCT north to Everett.

- Ensure long-term regional mobility, multimodal connectivity, and convenience for North Corridor citizens and communities, including travel-disadvantaged residents and low income and minority populations.
- Provide the transit infrastructure needed to support the development of Northgate and Lynnwood as designated regional growth centers providing housing, employment, public services, and multimodal transportation connections.
- Help support the environmental and sustainability goals of the state and region, including state regulations setting goals for reducing annual per capita vehicle miles traveled by 2050, in accordance with RCW 47.01.440, and the reduction of greenhouse gas emissions (Limiting Green House Gas Emissions, Chapter 702.35).

2.2 THE NORTH CORRIDOR

The North Corridor covers about an 8.5 mile distance between Northgate and Lynnwood, and generally follows I-5, which is the major north-south route through the state and serves a large commuter market traveling between Snohomish and King counties and the city of Seattle. The corridor is within a geographically constrained urbanized area that lies between Puget Sound to the west and Lake Washington to the east, which limits transportation options. This is one of the most densely developed urbanized areas in the Pacific Northwest and is part of a longer north-south corridor connecting Lakewood in Pierce County to Tacoma, Seattle, and Everett. Roadways in the North Corridor experience high levels of congestion throughout significant portions of the day, which affect mobility and reliability. This north-south corridor also comprises one of the region's most productive markets for transit, and has seen continuous and significant investments in public transit infrastructure and service over the past 40 years.

As a result of this investment, about 20,000 daily boardings occur on bus routes currently operating along this stretch of I-5, and nearly 30,000 occur in the overall corridor (i.e., on I-5, SR 99, and 15th Avenue NE combined). However, while the transit agencies that provide these services constantly endeavor to match service supply to demand, overloads do occur on some trips and are exacerbated as ridership demand rises in response to stimuli such as rising gasoline prices. For example during spring 2009, over one-quarter of all inbound and almost half of all outbound trips on Community Transit's express bus trips between Lynnwood Transit Center and downtown Seattle carried passenger loads that exceeded 90 percent of seat capacity at least 25 percent of the time. Eight percent of inbound and 13 percent of outbound trips exceeded capacity over 50 percent of the time (Community Transit 2010). This means many trips regularly had standees from Lynnwood to Seattle, a trip that can routinely take upwards of 40 minutes. Standees occurred even more often during 2008 when ridership was higher due to high gas prices. The transit agencies are regularly challenged to provide adequate service, a trend that has become markedly worse in recent years as operating costs have risen and revenues (predominantly sales tax) have fallen as the economy entered a severe recession.

Ridership forecasts done for the ST2 Plan between 2004 and 2008 consistently show strong ridership potential for fixed guideway investment in this corridor. Although the purpose of the AA is to consider a broad range of alternatives tailored to address the growing demands of the North Corridor, a recent 2030 forecast (Sound Transit 2010a) estimated that a prototypical light rail alignment along the I-5 corridor, as part of the larger system expansion included in ST2, would carry daily bi-directional rider volumes ranging from almost 32,000 at a screenline south of Lynnwood, to over 46,000 at a screenline just north of Northgate. PM peak direction volumes would range from 9,000 to almost 15,000 riders. Station boardings in 2030 could reach almost 16,000 per day at Lynnwood. This AA explores a range of modal options and potential alignments for the North Corridor, including light rail service, and compares their effectiveness in addressing the purpose and need for transit improvements in the North Corridor.

The North Corridor project would provide expanded regional transit service connecting to the Central Link light rail system at Northgate, as shown in Figure 2-1, in order to serve the large and growing travel market between Lynnwood, Snohomish County, and north King County and the other major activity and/or urban growth centers to the south at Northgate, the University of Washington, Capitol Hill, downtown Seattle, South Seattle, Tukwila, and SeaTac, as well as Bellevue and Redmond to the east.

2.3 PLANNING HISTORY

Transit has been part of the development of the North Corridor communities since the Interurban Railway began operating in the corridor in 1910, connecting Seattle to Everett. North Seattle, Shoreline, Mountlake Terrace and Lynnwood developed around the Interurban through 1938, when the line ceased operation. Buses operating along SR 99 became the primary mode of transit until I-5 opened in the early 1960s.

The region has recognized the need to provide HCT service between Seattle and Lynnwood for more than 40 years. The "Forward Thrust" regional transit system proposals of the late 1960s and early 1970s included fixed guideway transit between Seattle and Lynnwood, but funding for these regional plans was defeated at the polls. Since then, a largely commuter-oriented system of express bus services has developed to serve rapid population and employment growth along the I-5 corridor, helping to connect Snohomish County suburban residents to jobs in Seattle.

The region renewed its efforts to develop HCT service connecting Seattle and Snohomish County in the 1990s. In 1993, the Central Puget Sound Regional Transit Authority was created, and in 1995 the North Corridor was part of a large proposal for developing regional light rail connecting King, Pierce, and Snohomish counties; however, the voters did not approve that program. The following year, voters approved a scaled-back program known as *Sound Move* that included light rail in King County, along with improved bus services, commuter rail, and related facilities elsewhere in the system, including the North Corridor. The *Sound Move* program has been largely completed and is now in operation or under construction.

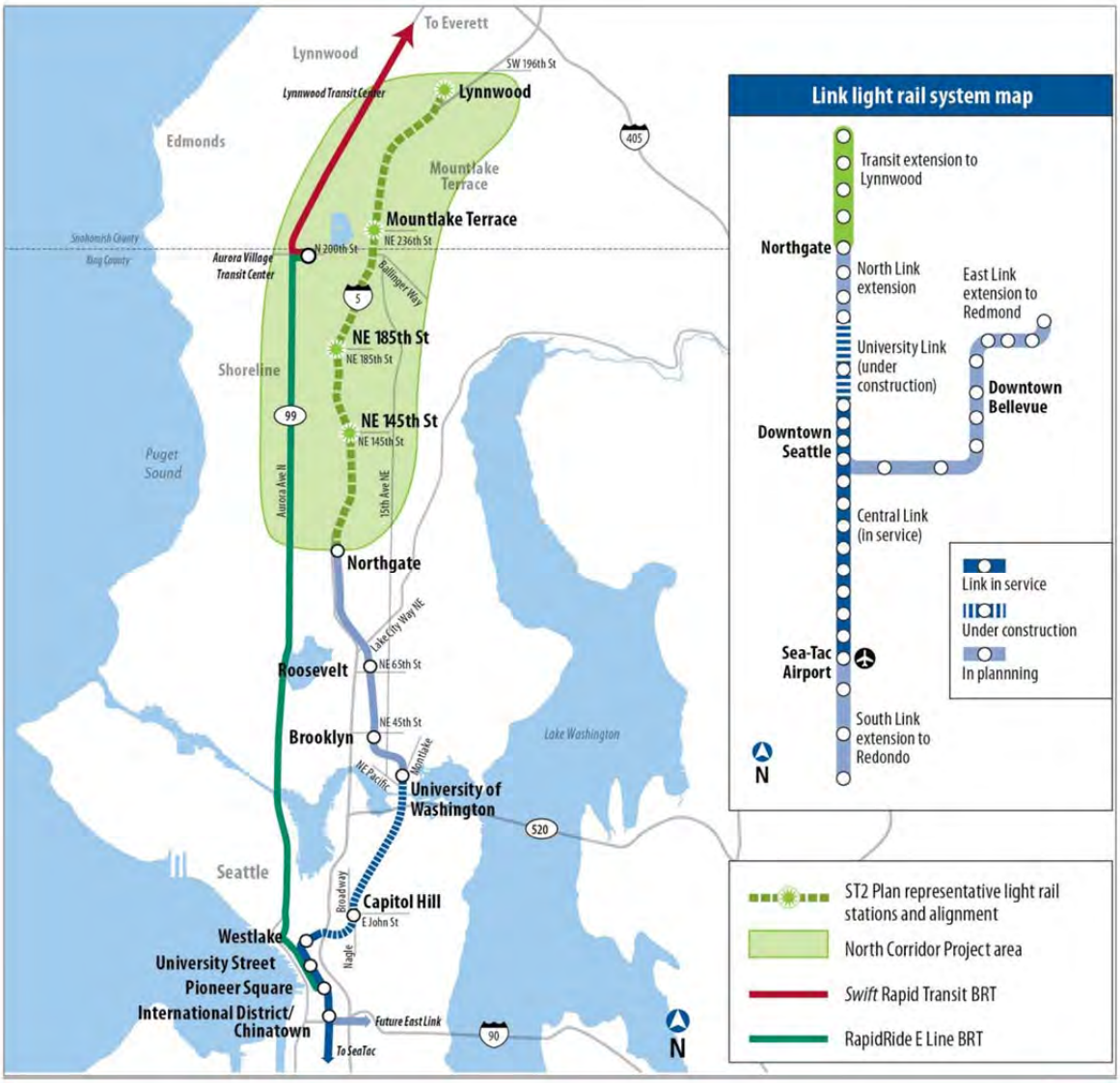


Figure 2-1. North Corridor Project Area and Relation to Link Light Rail System

2.3.1 PSRC High Capacity Transit Corridor Assessment

In 2004, PSRC conducted a *High Capacity Transit Corridor Assessment* (PSRC 2004), which applied regional demand forecasts to determine the relative potential of the corridor to support HCT. The study examined a range of HCT technologies including Enhanced Bus, Bus Rapid Transit (BRT), Light Rail, Monorail, Sky Train, and Diesel Multiple Units, and considered their capacity, speed, and reliability performance. The assessment also used an Independent Technical Review Committee consisting of public transit industry professionals from other regions to review the data analysis. The study (PSRC 2004) concluded an HCT extension between Northgate and Lynnwood was well supported in terms of travel demand, stating: "…the connection between Northgate and the Lynnwood CBD should be a priority for high capacity transit implementation in this corridor, given the land use activity and travel demand projected in that segment. This

link has the highest total transit demand and highest percentage of transit trips of all the study corridor segments."

2.3.2 Regional Transit Long-Range Plan

The Regional Transit Long-Range Plan was most recently adopted by Sound Transit in July 2005, updating and modifying the region's earlier regional transit long-range plan adopted in 1996. The Long-Range Plan represents Sound Transit's goals, policies, and strategies to guide the long-term development of the HCT system as it is developed through 2030 and beyond. Before adopting the plan, Sound Transit conducted an extensive public outreach program, including an environmental review of the Long-Range Plan elements in compliance with SEPA, culminating with the publication of the *Regional Transit Long-Range Plan Supplemental Final Environmental Impact Statement* in June 2005 (Sound Transit 2005b).

The Long-Range Plan provided the basis for the current ST2 Plan, and defined the vision for developing HCT throughout the region, including the North Corridor. The long-range planning effort comprised planning, engineering, and environmental studies, as well as public outreach throughout the region, including the North Corridor. As the Long-Range Plan was being considered for adoption by the Sound Transit Board in 2005, Sound Transit developed a series of issue papers focusing on HCT in the North Corridor. The papers evaluated rail and BRT as potential modal technologies for the corridor. They concluded that an HOV/BRT system would likely be less expensive to construct and operate, but light rail would carry more riders and provide faster travel times and more reliability. The issue papers also compared alignment options along I-5, SR 99, and 15th Avenue NE.

2.3.3 ST2 Plan Development

Between 2005 and 2008, Sound Transit developed a second phase system plan known as ST2. In 2008, the Sound Transit Board approved Resolution 2008-10, which adopted ST2 as Sound Transit's high-capacity transportation system plan, and identified the North Corridor Transit Project from Northgate to Lynnwood as one of the plan's major elements. Voters subsequently approved a November 2008 ballot measure that authorized local funding for ST2, including the North Corridor project.

2.3.4 Population and Employment in the North Corridor Communities

The North Corridor is home to established communities that are redeveloping and growing denser. The compact nature of these communities is reinforced by the geographic constraints of Puget Sound to the west and Lake Washington to the east. The region's largest and highest density city, Seattle, is to the south. Land use in the North Corridor is largely residential, but is anchored by the major regional commercial centers at Northgate and Lynnwood, with town centers and other activity centers located in between. The 2008 estimated population of Seattle, Shoreline, Mountlake Terrace and Lynnwood was over 700,000 (PSRC 2008) and employment was estimated at almost 550,000.

Regional and local plans anticipate higher levels of growth within the corridor through 2030, although the corridor is largely developed and already has a substantial population base today. Figures 2-2 and 2-3 show the forecasted growth densities expected in the corridor. Population near the corridor (defined as the set of forecast analysis zones immediately surrounding I-5 and Highway 99 between Northgate and Lynnwood) is forecasted to grow 21 percent by 2040. Employment over the same period is forecasted to grow by 39 percent. Most of the growth would be through redevelopment to higher densities in areas that are identified in regional and local plans as activity centers and regional growth centers. Figure 2-3 shows employment estimates by area districts for 2010 and 2030. High levels of growth have occurred and will occur in the North Corridor travel market area, including in the Everett, Lynnwood, North Seattle, and downtown Seattle districts.

2.4 DEMOGRAPHICS IN THE NORTH CORRIDOR COMMUNITIES

The U.S. Census data for the region are currently being updated to the year 2010, but demographic estimates are available through 2008 based on the 2000 Census with additional data from the American Community Survey. The 2008 estimates show Snohomish County with a population of nearly 674,000 and King County with 1,817,000. Cities within the corridor vary considerably in population as well as geographic size, with Lynnwood at 34,000, Mountlake Terrace at 20,000, and Shoreline at 51,000. Seattle's population was nearly 548,000 (U.S. Census Bureau 2000).

King and Snohomish counties share a similar racial composition, with 74 to 75 percent of the population identified as White, 12 percent as Black or African American, and Asian at 4 percent. People identifying as Hispanic or Latino (of any race) made up 15 percent of the population of the counties. At the local jurisdiction level, the demographic patterns were similar to those shown for their respective counties. These include household incomes that are 10 to 15 percent above the statewide average, an overall population that is younger than the statewide average, and a median household size that is slightly above the statewide average.

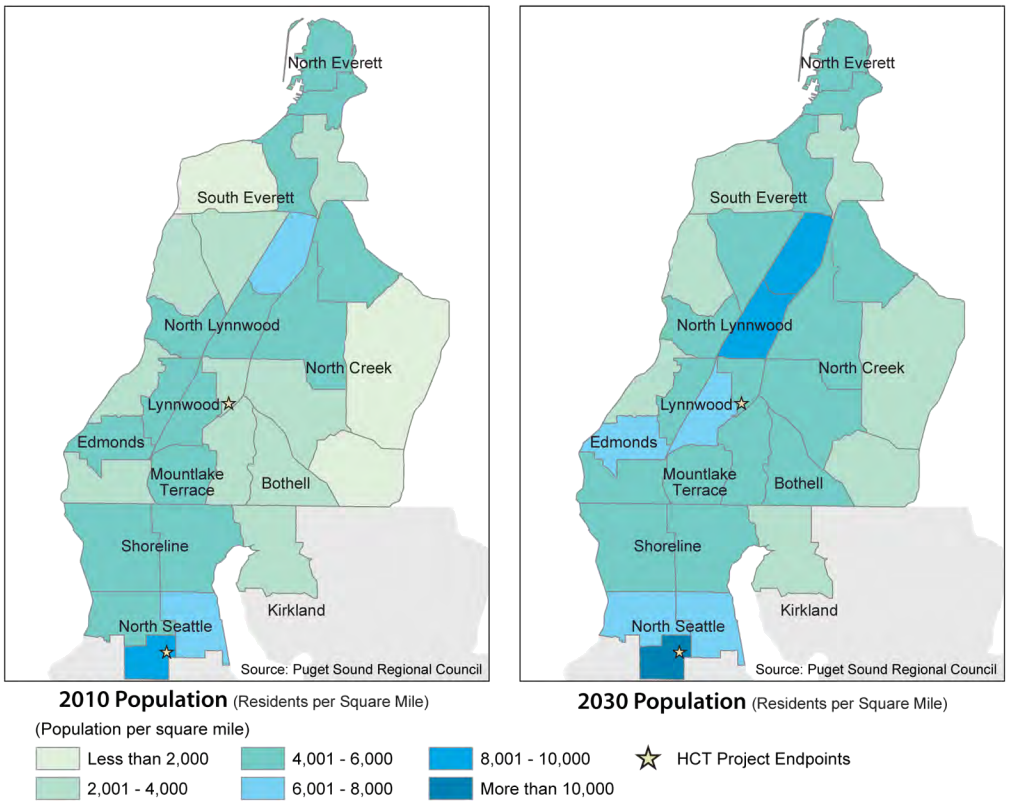


Figure 2-2. 2010 and 2030 Population Density Forecasts - North Corridor

North Corridor Transit Project | Alternatives Analysis Report

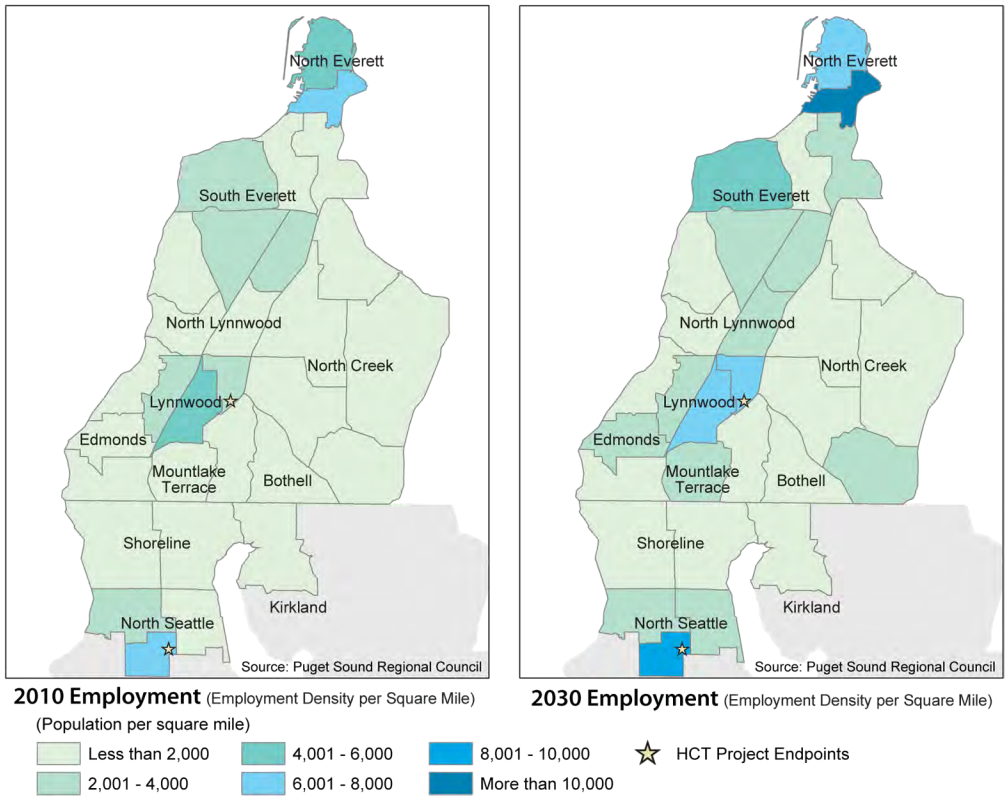


Figure 2-3. 2010 and 2030 Employment Density Forecasts - North Corridor

2.5 REGIONAL PLANS FOR MANAGING GROWTH

The Puget Sound region, which includes urbanized King, Pierce, Snohomish, and Kitsap counties, has a coordinated series of regional, county, and local plans and policies that are guiding how the region is managing its growth. The primary plans at the regional level are the PSRC's VISION 2040 (PSRC 2009) and *Transportation 2040* (PSRC 2010a). Sound Transit's Long-Range Plan serves as the HCT element of *Transportation 2040*. These plans share land use, growth management, and transportation policies that assume the regional HCT system will link the urban centers where the region's growth will be focused. County and local city comprehensive plan policies in the North Corridor and throughout the region reinforce the need for HCT investments to support new population and employment developments, as well as provide for vibrant urban communities that offer alternatives to the automobile.

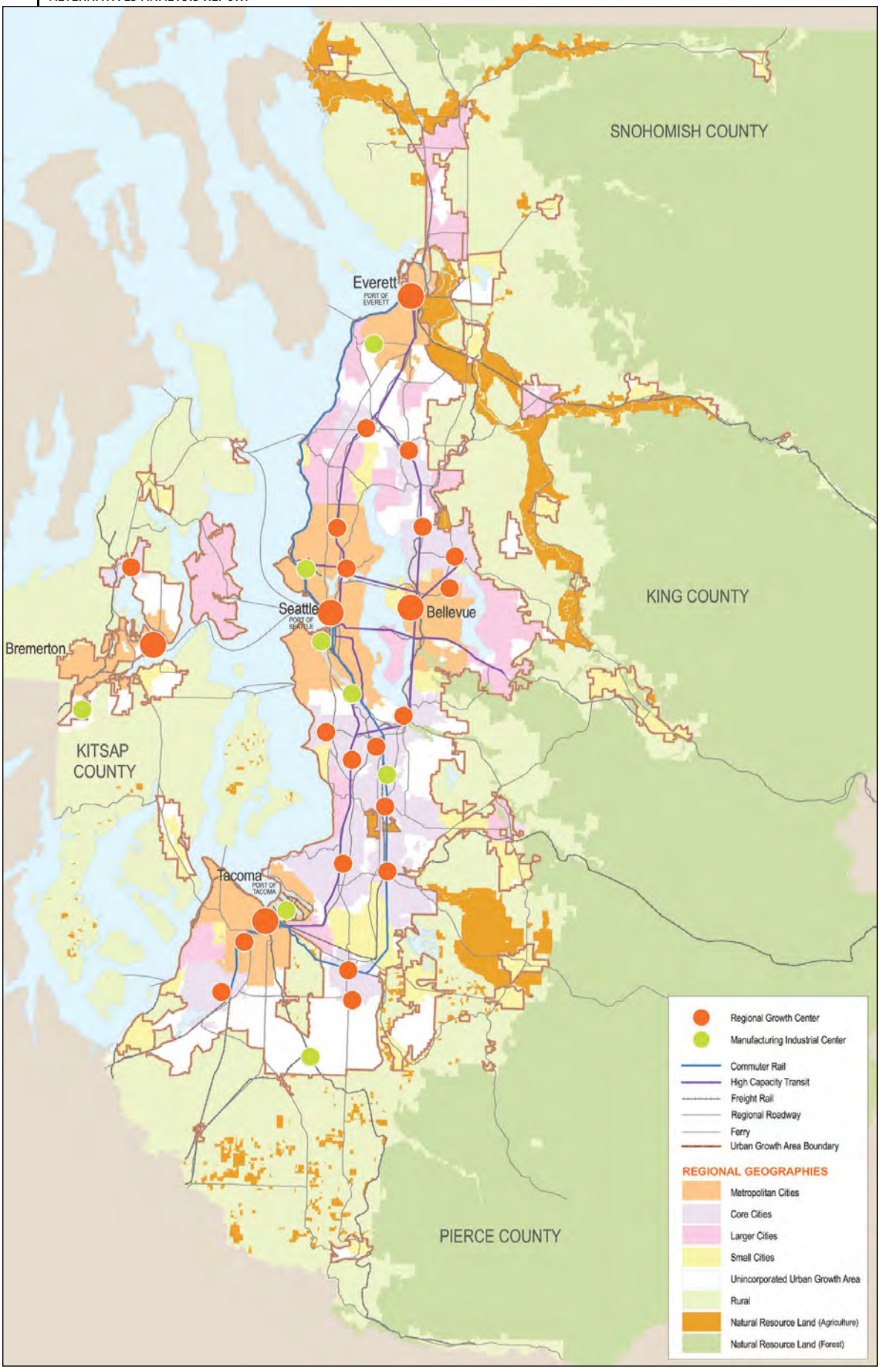
2.5.1 VISION 2040

VISION 2040, adopted by PSRC in May 2008, is the region's integrated, long-range vision for how and where the region should accommodate approximately 1.5 million people for a total population of 5 million, as well as 1.2 million new jobs for a total employment of nearly 3 million. VISION 2040's goals are to maintain a healthy region, promote the well-being of people and communities, ensure economic vitality, and preserve a healthy environment.

VISION 2040 identified regional growth centers (Figure 2-4), building upon urban centers concept that was originally established by VISION 2020. Northgate and Lynnwood are both designated as regional growth centers in VISION 2040. By 2030, the area surrounding the Northgate Link station is forecasted to have a density greater than 10,000 persons per square mile, and Lynnwood anticipates a population density between 5,000 and 10,000 persons per square mile near its city center.

2.5.2 Transportation 2040

Transportation 2040, which was adopted by PSRC in May 2010, is the region's metropolitan transportation plan and one of the key action plans to implement the VISION 2040 strategy over the next 30 years. The region's growth in jobs and population is expected to boost demand for travel within and through the region by about 40 percent. *Transportation 2040* outlines a long-term template for how this region should invest in transportation to accommodate rising travel demand. Sound Transit's North Corridor project is included in *Transportation 2040*.



Source: Puget Sound Regional Council VISION 2040

Figure 2-4. VISION 2040 Regional Centers

2.6 TRANSPORTATION SYSTEM

2.6.1 Highway Facilities

The North Corridor encompasses I-5 and SR 99—the two primary north/south highway facilities serving travel through the areas between Lake Washington and Puget Sound. I-5 is the most heavily traveled highway facility in the state, serving regional and interstate movements of both people and goods.

I-5 and SR 99 are the region's only continuous routes for the north/south movement of people and goods in the entire portion of the large urban area between Lake Washington and Puget Sound. While both transportation routes are highly used and highly congested for long periods of the day, I-5 is the most heavily used, carrying from 164,000 to 190,000 vehicles on an average day in the North Corridor (WSDOT 2009). SR 99 carries from 29,000 to 35,000 vehicles daily.

In addition to I-5 and SR 99, several other state highways, including SR 104, provide important east-west connections. The corridor's transportation network includes local streets; an extensive series of bus routes; transit centers and park-and-ride facilities; and HOV facilities, including direct access ramps. To the west of the North Corridor along Puget Sound is the Edmonds ferry terminal, as well as a major railroad line serving freight and Sounder commuter rail operations. The area also has a non-motorized system that includes the Interurban Trail, which serves north/south bicycle and pedestrian trips.

Physical and environmental constraints limit the addition of more highway capacity in the corridor; *Transportation 2040* does not include major expansions of highway capacity in the corridor. Current high levels of travel demand are expected to continue to grow, and congestion and unreliability for travelers on I-5 and SR 99 will increase through 2040 (PSRC 2010b).

Washington State Department of Transportation (WSDOT) has unfunded plans to make operational improvements to I-5 in the future, such as short segments of new auxiliary lanes between interchanges as they rebuild the over 40-year-old pavement along the corridor during the next decade. Active traffic management systems such as variable speed lane management signage are also planned. At the state level and regionally, policymakers are discussing further traffic management measures such as tolling, but no decisions have yet been made about tolling on any portions of I-5.

TRANSPORTATION SYSTEM PERFORMANCE

As a result of the high volume of travel and limited facilities in the North Corridor, peak-period travel is consistently congested and travel times are unreliable. For example, as shown in Figure 2-5, WSDOT's time reliability calculator shows a trip from Everett to Seattle at free-flow speeds should take about 24 minutes on I-5 (WSDOT 2009).

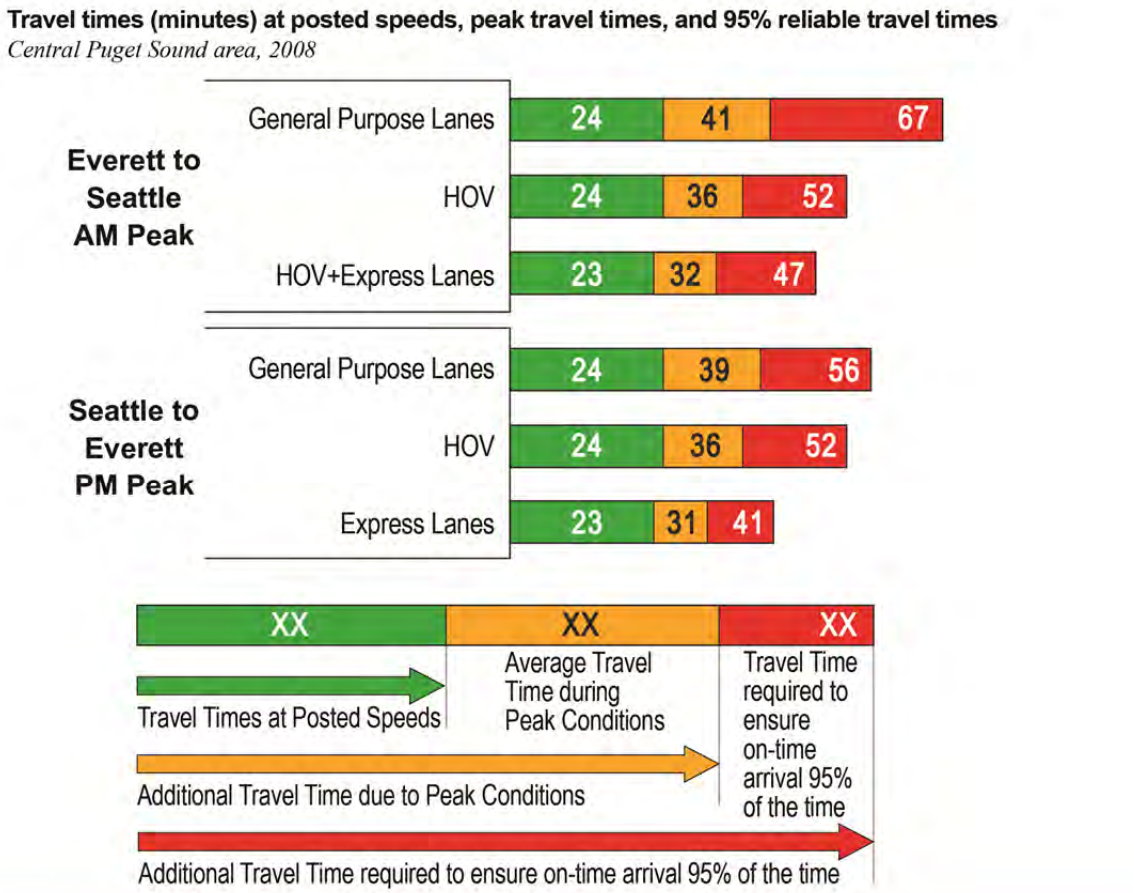


Figure 2-5. Travel-Time Reliability for the Everett-to-Seattle Commute via I-5

Because of the high levels of congestion and unpredictability in delays, a commuter must allow 67 minutes for the trip during the AM peak hour to ensure arriving on time 95 percent of the time. Reverse commute trips are also unreliable. For example, afternoon southbound traffic on I-5 regularly backs up into Shoreline because the express lanes are unavailable (they operate northbound in the afternoon) and because of congestion related to the I-5/SR 520 merge south of the project area.

Unreliable travel on I-5 HOV lanes during the peak period is a problem because that is when most transit service occurs. The WSDOT-adopted HOV lane policy is that HOV lanes must maintain an average speed of 45 miles per hour (mph) or greater at least 90 percent of the time during the morning and afternoon rush hour. Data show that the I-5 HOV lanes in the North Corridor do not currently meet this performance standard. In 2007, HOV lane speeds in the southbound direction fell below the 45-mph threshold up to 65 percent of the time in the AM peak period, and northbound HOV lanes fell below the threshold nearly 50 percent of the time in the PM peak period.

HOV lane reliability is also affected by the operation of the adjacent general purpose lanes. Travel on HOV lanes is often slowed when there is nearby slow traffic in the general purpose lane (i.e., "lane friction"). Drivers in the HOV lane are often reluctant to travel at speeds that are

significantly greater than the speed of vehicles in the adjacent lane. Also, when HOV drivers need to leave the HOV lane and enter a congested general purpose lane, they often slow down to wait for a gap in the adjacent lane to enter, blocking traffic on the HOV lane. All these factors play roles in creating the overall experience of delay and unreliability in the I-5 HOV lanes.

2.6.2 Transit System

The corridor has an extensive network of bus routes, most traveling generally north and south to connect the North Corridor communities and neighborhoods to job centers in King County and north to Everett. Thirty-six weekday bus routes provided by three transit agencies operate through the corridor along I-5, connecting North Corridor communities to downtown Seattle, the First Hill and Capitol Hill employment areas to the east of downtown Seattle, the University of Washington, and the growing employment centers east of Lake Washington. The majority of the routes are peak-period, peak-direction, point-to-point services linking south Snohomish County, north King County neighborhoods, and park-and-ride lots to major employment centers in King County. However, about one-third of all daily bus trips are provided on four two-way, all-day routes, and nearly one-sixth of the trips are made southbound on I-5 between 6:30 and 7:30 am—with an average frequency of one bus every 38 seconds during this 1-hour period.

Many of the routes begin in residential neighborhoods but make their way to I-5 interchanges via local arterial streets. Once on I-5, HOV lanes are located in the center of the freeway between Lynnwood to Northgate. However, as bus routes continue south toward downtown Seattle, the HOV system transitions to limited access reversible express lanes at Northgate. The express lanes help accommodate peak direction flows at different times of day (inbound to Seattle in the morning, outbound in the afternoon), but delays and bottlenecks are frequent. Transit and HOVs in the off-peak direction must use the general purpose lanes between downtown Seattle and Northgate, which can experience substantial congestion. In downtown Seattle, dedicated ramps for transit and HOV provide access to and from the express lanes, but the express lanes are open to all users and are frequently congested. Transit priority lanes are also provided on several downtown streets to help speed buses through the downtown core, and the Downtown Seattle Transit Tunnel (DSTT) provides exclusive right-of-way for joint light rail and bus operations. (Two rush-hour only bus routes serving the North Corridor study area currently use the tunnel.) There are no transit priority treatments on surface streets between I-5 and the University of Washington campus; moreover, no direct access/HOV ramps serve the Northgate Transit Center from the I-5 HOV lanes to and from the north.

Several sections of the North Corridor feature investments to help improve transit speed and reliability. I-5 has continuous inside HOV lanes from Everett south to Northgate. Business access transit lanes are on SR 99 from NE 115th Street to NE 160th Street, and again from SR 104 (just north of the King County/Snohomish County line) north to Everett. A "Texas T" HOV direct access ramp connects the Lynnwood Transit Center to the center HOV lanes. In addition, a center in-line freeway transit station with ramps to and from the HOV lanes was completed in 2011 at the Mountlake Terrace Transit Center near the Snohomish County/King County line. An outside freeway station is available at NE 145th Street, but buses must weave across general

purpose lanes from and to the inside HOV lanes to serve it. Consequently, most peak period bus routes bypass this station. Ramp metering and HOV bypass lanes are also used on most interchange ramps to help control the flow of traffic onto the freeway.

2.6.3 Transit Travel Patterns

Figure 2-6 shows the pattern of trips made by transit in the North Corridor, as represented in Sound Transit's forecasting model for 2010 conditions. Figure 2-7 shows 2008 transit trips using I-5, SR 99, and 15th Avenue NE covering the section between Lynnwood and Seattle. Much of this travel consists of commuters from north King County and south Snohomish County destined for downtown Seattle and the University District—two major employment centers in the region.

As of 2008, daily transit ridership on I-5 ranged from 26,400 riders per day just south of Northgate to 15,100 riders per day at Lynnwood (Sound Transit 2010b). SR 99 carries a substantial amount of transit riders as well, though only about a quarter of what I-5 carries. The primary transit routes along SR 99 are Community Transit's *Swift* BRT service between the Everett Station and the Aurora Village Transit Center, and King County Metro's Route 358 between the Aurora Transit Center and downtown Seattle. While these routes carry some longer distance trips (e.g., from Aurora Village to downtown Seattle), much of the market served is shorter trips to/from destinations within the corridor. In 2008, combined transit ridership on I-5, SR 99, and 15th Avenue NE was 36,500 daily trips just south of Northgate and 17,500 trips at Lynnwood.

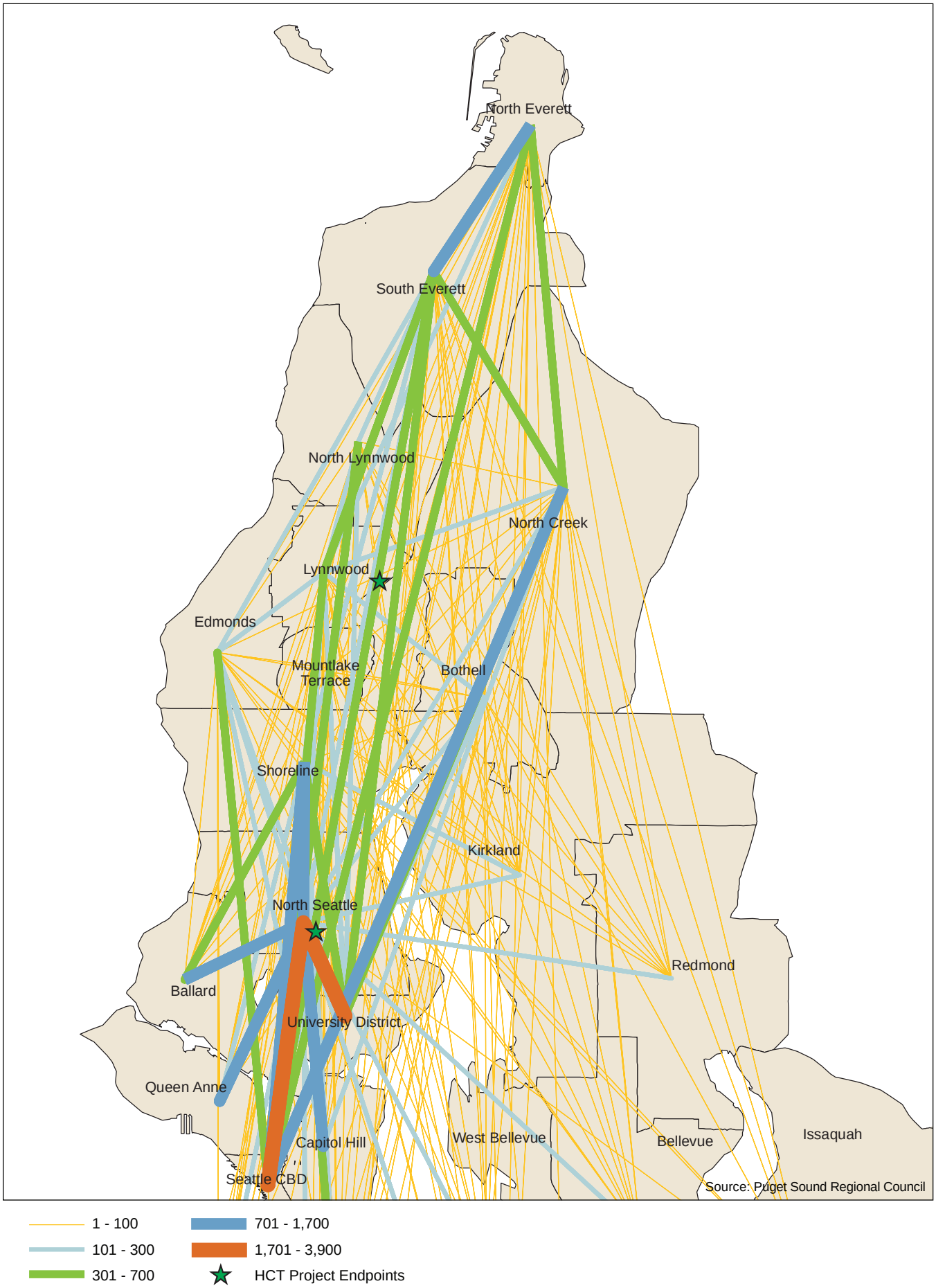


Figure 2-6. Distribution of 2010 Daily Transit Trips to/from North Corridor

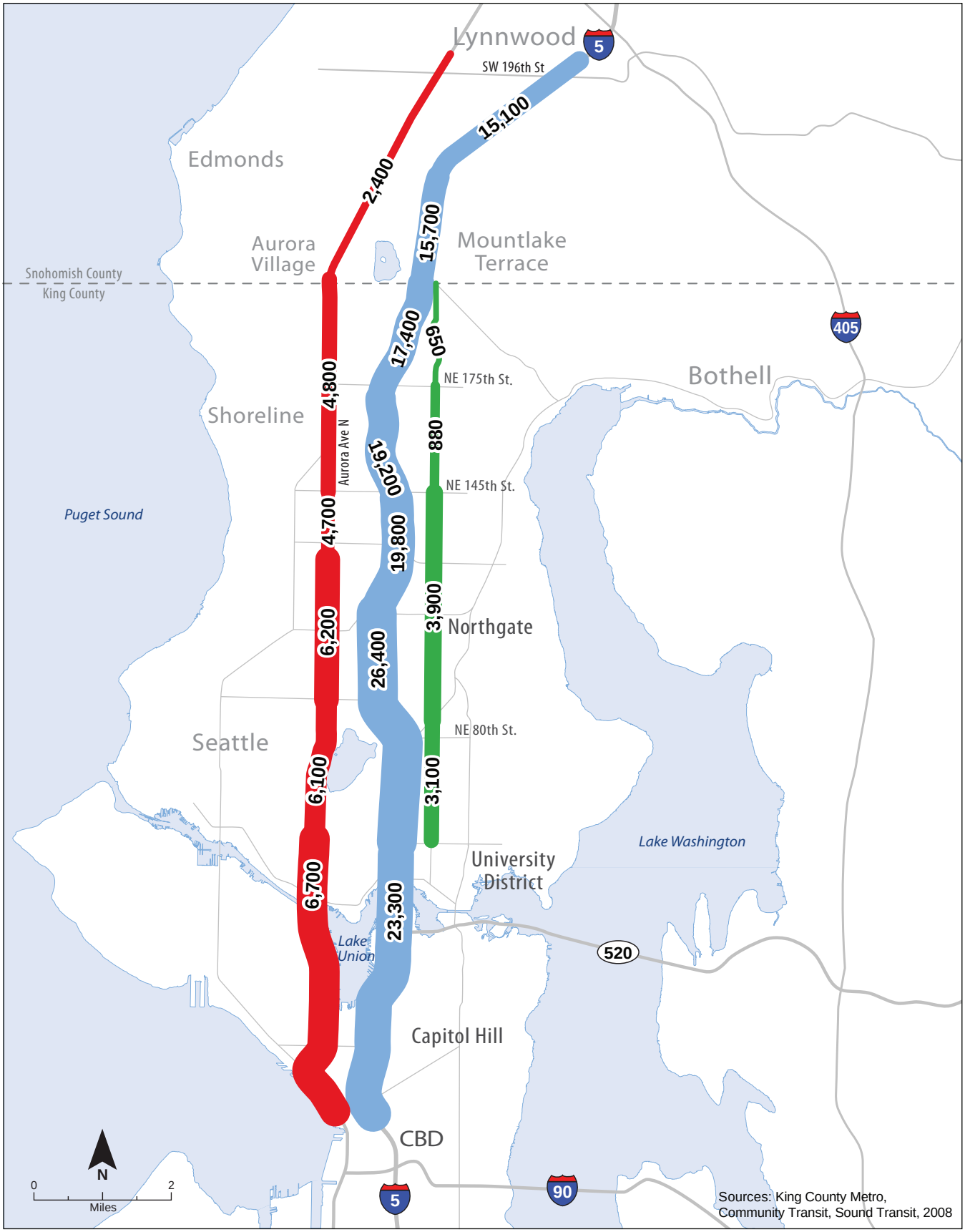


Figure 2-7. Existing Daily Transit Ridership for the North Corridor

3 DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 OVERVIEW

This chapter provides a summary of the process used to develop the detailed alternatives that are described in Chapter 4 and evaluated in Chapter 5. The alternatives development and evaluation process consists of three stages as summarized in Figure 3-1: initial concept development and screening, Level 1 alternatives development and evaluation, and Level 2 alternatives development and evaluation. The sections that follow summarize the findings of the first two steps in the process. Further details can be found in the *Final Level 1 Alternatives Analysis and Evaluation* report (Sound Transit 2011a). The chapter also discusses the criteria and methodology used to evaluate the alternatives at each step of the process. The alternatives are also described as they evolved through the three evaluation stages, including the alternatives and options that were dropped at each stage. The last section of this chapter describes the alternatives carried forward into the Level 2 evaluation. Chapter 6 gives an overview of the early scoping process that was used to consult with the public, agencies, and tribes as well as the results of these discussions.

3.2 EVALUATION PROCESS

3.2.1 Basis in Purpose and Need

The North Corridor Transit Project's Purpose and Need, described in Chapter 2, is summarized into six broad categories that form the basis for the development of the screening and evaluation criteria at each step of the process. These categories are as follows:

- Transportation effectiveness in meeting mobility, access, and capacity needs
- Equitable community impacts and benefits
- Supportive land use and economic development effects

- Preservation of a healthy environment
- Affordable and constructible project
- Consistency with Sound Transit's long-range vision

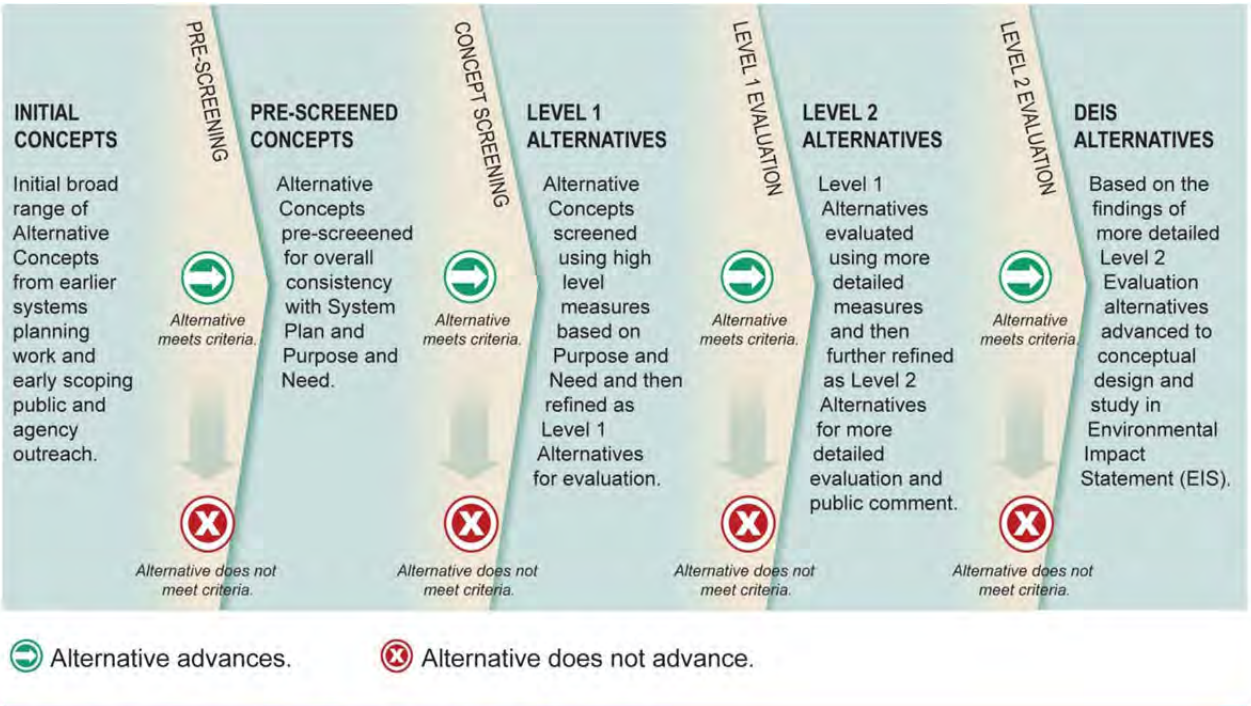

INITIAL CONCEPTS
Initial broad range of Alternative Concepts from earlier systems planning work and early scoping public and agency outreach.
PRE-SCREENING
Alternative meets criteria.
Alternative does not meet criteria.
PRE-SCREENED CONCEPTS
Alternative Concepts pre-screeened for overall consistency with System Plan and Purpose and Need.
CONCEPT SCREENING
Alternative meets criteria.
Alternative does not meet criteria.
LEVEL 1 ALTERNATIVES
Alternative Concepts screened using high level measures based on Purpose and Need and then refined as Level 1 Alternatives for evaluation.
LEVEL 1 EVALUATION
Alternative meets criteria.
Alternative does not meet criteria.
LEVEL 2 ALTERNATIVES
Level 1 Alternatives evaluated using more detailed measures and then further refined as Level 2 Alternatives for more detailed evaluation and public comment.
LEVEL 2 EVALUATION
Alternative meets criteria.
Alternative does not meet criteria.
DEIS ALTERNATIVES
Based on the findings of more detailed Level 2 Evaluation alternatives advanced to conceptual design and study in Environmental Impact Statement (EIS).
Alternative advances.
Alternative does not advance.

Figure 3-1. Alternatives Analysis Evaluation Framework

TRANSPORTATION EFFECTIVENESS AND COMMUNITY EQUITY

The transportation effectiveness and community equity categories relate the first two Purpose Statements of improving regional mass transit service from Seattle north into Snohomish County by:

1) *Providing reliable, rapid, and efficient two-way, peak and off-peak transit service of sufficient capacity to meet the existing and projected demand between the communities and activity centers located in the North Corridor and the other urban centers in the Central Puget Sound area; and*

2) *Providing a mobility alternative to travel on congested roadways, and improving connections to the regional multimodal transportation system.*

The transportation effectiveness and community equity categories are derived from the following Need Statements:

a) *Meet the rapidly growing needs of the corridor and the region's future residents and workers by increasing mobility, access, and transportation capacity to and from regional growth and activity centers in the North Corridor and the rest of the region, as called for in the region's adopted plans, including PSRC's VISION 2040 and Transportation 2040, as well as related county and city comprehensive plans.*

b) *Address the problems of increasing and unreliable travel times for transit users in the North Corridor, who are now dependent on the corridor's highly congested roadway and HOV systems.*

c) *Address overcrowding facing current and future North Corridor transit riders due to insufficient capacity of the current transit system.*

d) *Provide an alternative to automobile trips on I-5 and SR 99, the two primary highways serving the corridor, which are unreliable and over capacity throughout significant portions of the day.*

e) *Ensure long-term regional mobility, multimodal connectivity, and convenience for North Corridor citizens and communities, including travel-disadvantaged residents and low-income and minority populations.*

LAND USE AND ECONOMIC DEVELOPMENT EFFECTS AND ENVIRONMENTAL PERFORMANCE

The land use and economic development effects and environmental performance categories were derived from the third Purpose Statement of improving regional mass transit service from Seattle north into Snohomish County by:

3) *Supporting North Corridor communities' and the region's adopted land use, transportation and economic development vision, which promotes the well-being of people and communities, ensures economic vitality, and preserves a healthy environment.*

The land use and economic development effects and environmental performance categories were derived from the following Need Statements:

f) *Provide the transit infrastructure needed to support the development of Northgate and Lynnwood as designated regional growth centers providing housing, employment, public services, and multimodal transportation connections.*

g) *Help support the environmental and sustainability goals of the state and region, including state regulations setting goals for reducing annual per capita vehicle miles traveled by 2050, in accordance with RCW 47.01.440, and the reduction of greenhouse gas emissions (Limiting Green House Gas Emissions, Chapter 702.35).*

COST, CONSTRUCTABILITY, AND CONSISTENCY WITH SOUND TRANSIT'S LONG-RANGE VISION

The cost, constructability, and consistency with Sound Transit's Long-Range Vision categories were derived from the fourth Purpose Statement of improving regional mass transit service from Seattle north into Snohomish County by:

> 4) *Supporting the long-range vision, goals, and objectives for transit service established by Sound Transit's Long-Range Plan for high quality regional transit service connecting major activity centers in King, Pierce and Snohomish counties, including a connection between Seattle and Everett.*

The cost, constructability, and consistency with Sound Transit's Long-Range Vision categories were derived from the following Need Statement:

> h) *Implement the long-range vision for HCT service established by Sound Transit's Long-Range Plan, with a regional transit investment that supports economic vitality, preserves the environment, preserves communities, and allows for the future extension of HCT north to Everett.*

Sound Transit's Long-Range Plan (Sound Transit 2005a) includes the ultimate development of light rail transit to connect and serve the four major regional centers—Everett, Seattle, Tacoma, and Bellevue, as well as the following cost-related objectives:

- Offer cost-effective and efficient transportation solutions within available resources, and
- Create a financially feasible system that is affordable to build, run, and use.

As a result, consistency with Sound Transit's Long Range Plan is determined based on the capacity to accommodate ridership growth associated with future extensions of transit service north to Everett as well as cost effectiveness and financial feasibility based on Sound Transit's current financial plan.

3.2.2 Evaluation Methodology and Criteria

The Purpose and Need was used to develop the evaluation criteria and measures; these criteria are grouped by the broad categories described above. The AA evaluation process used to determine the alternatives to be carried forward into the next stages of project development is illustrated in Figure 3-1. Each evaluation level employed criteria and measures that address FTA's Alternatives Analysis and New Starts guidelines as well as the project's Purpose and Need. The alternatives evaluation consisted of three major steps:

1. Initial Concept Screening and Alternatives Development: Before the start of the initial screening, a pre-screening was conducted to assess whether proposed concepts were consistent with the definition of the North Corridor as identified in Sound Transit's 2005 *Regional Transit Long-Range Plan* (Sound Transit 2005a) and whether they met the project's Purpose and Need. Those concepts surviving pre-screening were developed further, while those that did not were screened out. The surviving concepts were then further evaluated and refined to form the Level 1 Alternatives.

2. Level 1 Alternatives Evaluation: The Level 1 evaluation employed quantitative and qualitative assessments of benefits, impacts, and costs of a refined set of alternatives. Alternatives that were determined to have sufficient merit were carried forward, modified, and refined for the Level 2 evaluation. Poorly performing alternatives were dropped from further consideration.

3. Level 2 Alternatives Evaluation: The Level 2 evaluation was a detailed evaluation of further refined alternatives using more quantitative analysis and information. Alternatives that were determined to have sufficient merit are recommended to be evaluated in the Draft EIS.

Table 3-1 lists the screening criteria and measures that were used in the initial concept development. Table 3-2 lists the evaluation criteria and measures used in the Level 1 and Level 2 evaluations. The criteria and measures are grouped in the tables by the broad categories described above in order to link them back to the project's Purpose and Need Statements. A more detailed discussion of these criteria and how they were used is contained in the *Alternatives Evaluation Framework, Criteria, and Methodologies Technical Memorandum* (Sound Transit 2011b).

Table 3-1. Initial Concept Development Review Screening Criteria and Measures

Screening Criteria	Measures
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access, and Capacity Needs	
Rider Benefits	Peak-period travel time from the Lynnwood Transit Center and Shoreline to Northgate Link light rail station, including transfer time to rail at Northgate
Reliability	Miles of operation on non-exclusive guideway Number of at-grade intersections traversed
Capacity	Passengers per hour per direction
Connections to Regional Multimodal Transportation System	Number of transfers to reach regional transit system at Northgate
Purpose and Need: Equitable Community Impacts and Benefits	
Not used for initial concept development review	
Purpose and Need: Supportive Land Use and Economic Development Effects	
Land Use and Economic Development Potential	Number of identified existing and future activity centers within 0.5 mile of alignment
Purpose and Need: Preservation of a Healthy Environment	
Environmental Considerations	General requirements for new right-of-way and associated implications Qualitative impacts on existing transportation systems
Purpose and Need: Cost and Constructability	
Cost Considerations	Major cost factors associated with each concept
Purpose and Need: Consistency with Sound Transit's Long-Range Plan	
Accessibility to PSRC-designated Regional Growth Centers	Peak period travel times in both directions between representative PSRC Regional Growth Centers and Lynnwood Number of PSRC Regional Growth Centers reachable via one seat ride from Lynnwood

Table 3-2. Levels 1 and 2 Evaluation Criteria and Measures

Level 1 Evaluation Measures	Level 2 Evaluation Measures
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access, and Capacity Needs	
Project Daily Riders Annual New Riders User Benefit Estimate—Annual Hours of Travel Time Saved Practical Capacity (Directional Passenger/Hour) Peak Transit Travel Time: Lynnwood to Northgate Operations on Non-Exclusive Right-of-Way Number of At-Grade Signalized Intersections Traversed	2030 Project Daily Riders 2030 Annual New Riders 2030 Annual Hours of Travel Time Saved 2030 New Weekday Transit Trips to Regional Center Capacity in passengers per hour per direction 2030 Peak Hour Passenger Demand/Capacity 2030 Peak Transit Travel Time: Lynnwood to Northgate 2030 Transit to Auto Travel Time Comparison (Peak Lynnwood to Northgate) Operations on Non-Exclusive Right-of-Way Signalized Intersections Traversed Number of Transfers to Reach Major Destinations 2030 Reduction in Weekday Vehicle Miles Traveled
Purpose and Need: Equitable Community Impacts and Benefits	
Not considered for Level 1 screening.	Impacts to Affected Communities Transportation Benefits to Affected Communities
Purpose and Need: Supportive Land Use and Economic Development Effects	
Consistency with PSRC's VISION 2040 and Regional Economic Strategy Consistency with comprehensive plans, land use and zoning Total existing and forecast population and employment within 0.5 mile of stations Number of activity centers within 0.5 mile of stations	Consistency with *PSRC's* VISION 2040 and Regional Economic Strategy Station area existing land use orientation and character Station area existing and forecast population, employment and housing Station area mix of uses Connectivity to major trip generators Station area transit supportive plans and policies
Purpose and Need: Preservation of a Healthy Environment	
New Transportation Right-of-Way Requirements Impacts on General Purpose Traffic Operations	Ecosystems Effects Water Resources Effects Potential Park or Historic Resources Effects, Including Section 4(f) Properties Reduction in Air Pollutants and Greenhouse Gas Emissions Visual Impacts Potential for Noise Impacts Requiring Mitigation Potential Land Acquisitions (Acres) Traffic Impacts Pedestrian and Bicycle Travel Construction Effects on Transportation System

Table 3-2. Levels 1 and 2 Evaluation Criteria and Measures

Level 1 Evaluation Measures	Level 2 Evaluation Measures
Purpose and Need: Cost and Constructability	
Capital Cost 2030 Annual O&M Cost	Capital Costs 2030 Net Annual Operations and Maintenance Costs Cost per Hour of 2030 User Benefits Incremental Cost per 2030 New Passenger
Purpose and Need: Consistency with Sound Transit's Long-Range Plan	
Operations in General Purpose Traffic Lanes Consistency with Definition of HCT in Long-Range Plan	Meets State Definition of HCT Consistent with Sound Transit Long-Range System Plan, as measured by capacity to accommodate ridership growth and consistency with Sound Transit's current financial plan.

3.3 INITIAL CONCEPT DEFINITION

Initial concepts were identified and screened by the project team through an iterative process. The North Corridor is characterized by a very mature and well-used public transit system operated by three public transit agencies, along with supporting transit and HOV facilities developed and maintained by WSDOT. The project area also has a long and rich history of transportation studies aimed at addressing many of the issues identified in the project's Purpose and Need. The findings of the recently completed system planning study and other previous studies, documented in the *Previous Studies and Findings Technical Memorandum* (Sound Transit 2010c), as well as input from agency staff and the public through early scoping, were the basis for the development of the initial list of alternative concepts.

3.3.1 Early Public and Agency Involvement

Sound Transit undertook a significant public and agency outreach effort early in the AA process to gather input on the project's Purpose and Need, the evaluation and screening criteria, and the initial alternatives. Chapter 6 provides a detailed description of those efforts.

Sound Transit and the FTA undertook early scoping, which is an optional step in the state and federal environmental review processes, to engage the public and stakeholders in the AA study process, before defining formal alternatives that would undergo more detailed engineering and environmental study. The early scoping process for the North Corridor Transit Project began September 24, 2010 with a series of public notices, advertisements, and mailings and continued through October 27, 2010. Three public meetings and an agency meeting were held and public comments were received in a wide variety of formats.

The project used an online questionnaire tool, which was available on the project Web site (http://www.soundtransit.org/NorthHCT) throughout the early scoping period.
Nearly 275 people completed the questionnaire, and almost half of them submitted additional informal written comments at the end of their entry. Nearly 90 written comment letters were received; nine of these comment letters were provided by state and local agencies. Several key themes emerged from the public meetings and online questionnaire tool regarding the alternatives as follows:

- Light rail was the mode suggested by most participants, which was expected because voters had recently approved local funding for light rail in the 2008 ST2 ballot measure.
- Most people said that ease of access to the regional transit system was important, including strong east-west connections with coordinated and direct feeder buses, sufficient park-and-ride capacity, and easy bicycle and pedestrian access.
- Most people identified either I-5 or SR 99 as appropriate routes for the system. Several thought 15th Avenue NE should be considered.
- Responses about potential station areas and numbers of stations were mixed. Many people understood why the planned location of system termination is at the Lynnwood Transit Center, but many asked if it could be extended farther north to Alderwood Mall. Many people thought the new Mountlake Terrace Transit Center could provide good access to the system, whereas comments varied about potential southern station areas on I-5 and potential station areas on SR 99.
- Overall, participants wanted to know more about the potential tradeoffs and impacts of the project. Some expressed concerns about how the project would be affected by Sound Transit's current financial situation and tradeoffs being explored by the Sound Transit Board.

3.3.2 Operating Strategy

Development of the initial concepts began with high-level consideration of a transit operating strategy to address the project's Purpose and Need in the context of the regional transportation plan, Sound Transit's Long-Range Plan, and the identified travel markets.

OPERATING STRATEGY AS IT RELATES TO ADOPTED PLANS

Two current adopted plans in the region (*Transportation 2040*, May 2010; *Sound Transit Regional Transit Long-Range Plan*, July 2005) call for light rail transit, linking the region's four major regional centers—Everett, Seattle, Tacoma, and Bellevue. Connecting the interim light rail terminus at Northgate with Lynnwood is a key component of the ultimate connection to Everett. As a result, this North Corridor segment will ultimately serve a large "through" movement market—requiring sufficient capacity and service levels (i.e., frequent headways [the time between successive train movements in a given direction], higher speeds, and reliability) necessary for this critical connection between Everett and Seattle. The alternative concepts for

the Northgate-to-Lynnwood segment were crafted and screened with this ultimate objective in mind.

OPERATING STRATEGY AS IT RELATES TO TRANSIT MARKET

An analysis of transit ridership patterns in the North Corridor was conducted at the outset of the AA process. Results are contained in the *Project Context and Baseline Conditions Technical Memorandum* (Sound Transit 2010b). Table 3-3 summarizes the estimated daily transit trip pairs between the North Corridor and all other districts. Each of the districts is ranked based on the number of existing (2010) transit trip pairs. This information is also shown graphically in Figure 2-6 in Chapter 2.

As shown in Table 3-3 (and illustrated in Figure 2-6 in Chapter 2), the Seattle central business district (CBD) is the single largest market for transit trips from the North Corridor; the second largest market for transit trips is the University District. In light of these factors, it was important to design alternative operating concepts that provide a high level of service to these activity centers, both in terms of capacity and speed.

Table 3-3. Estimated Existing Daily Transit Trip Pairs from the North Corridor to Various Districts

District Name	Share of Total Transit	District Name	Share of Total Transit
Seattle CBD	22.3%	North Lynnwood	1.3%
University District	15.3%	Bothell	1.2%
North Seattle	11.4%	West Bellevue	1.1%
Ballard	6.4%	West Seattle	0.9%
Shoreline	5.5%	Redmond	0.6%
Capitol Hill	5.4%	Bellevue	0.5%
South Everett	5.3%	SeaTac	0.5%
Lynnwood	4.9%	Renton	0.4%
Queen Anne	3.8%	Kent	0.1%
Rainier	3.2%	Issaquah	0.1%
North Everett	2.4%	Lakewood	0.0%
North Creek	2.2%	Federal Way	0.0%
Edmonds	2.0%	North Tacoma	0.0%
Kirkland	1.8%	Puyallup	0.0%
Mountlake Terrace	1.5%	South Tacoma	0.0%
Total	**93.4%**	**Total**	**6.7%**

Source: Sound Transit Regional Transit Ridership Forecasting Model

Ideally, this would be accomplished by providing a one-seat ride on the regional transit system to both downtown Seattle and the University District from the North Corridor. The rail concepts, by virtue of linking into the rail system at Northgate, inherently provide a one-seat ride on the regional system to both destinations. Existing express bus services that directly connect the corridor with the Seattle CBD and the University of Washington were assumed to be eliminated with the rail concepts. However, the BRT and transportation systems

management (TSM) concepts, which require a bus-to-rail transfer at Northgate, do not in themselves provide a one-seat ride to these key destinations. Hence, it is assumed that the existing parallel express bus services directly serving the Seattle CBD and the University District from key points within the corridor are maintained for these concepts. The result is that with the TSM and BRT concepts, three separate routes would serve Northgate, the University District, and the Seattle CBD as shown in Figure 3-2.

In addition to serving the two primary regional center destinations, another need is to improve regional access to the North Corridor communities from all other activity centers. The existing regional express bus system adequately connects (albeit with the inherent traffic congestion-related reliability and travel time problems) the project area to the Seattle CBD and the University District. However, travel to other major centers is poorly served by this system. Thus, the ultimate operating strategy for the rail alternatives (once the remainder of the Sound Transit system is complete) is a one-seat ride to all regional centers. For the bus alternatives, the strategy is to augment the one-seat ride service provided to the Seattle CBD and University District with the best two-seat ride available through a transfer to light rail at Northgate.

Finally, while this project will connect North Corridor communities with other activity centers, it will also ultimately serve as a segment in the larger regional system extending north to Everett. Thus, the operating strategy for this corridor must be designed to accommodate the larger "through market" as well as trips beginning or ending within the project area.

3.3.3 Concepts Eliminated in Pre-Screening

Two concepts were eliminated in pre-screening because they were judged to be inconsistent with Sound Transit's Long-Range Plan and failed to meet the project's Purpose and Need.

LAKE CITY WAY/SR 522 ALIGNMENT

This concept would use Lake City Way/SR 522 to connect Northgate to Lynnwood. SR 522/Lake City Way lies to the east of the study corridor and runs generally northeast/southwest. The SR 522/Lake City Way alignment is longer than any other route considered, and does not connect the communities and travel markets served by the current major north-south transit system the project is intended to improve.

In Sound Transit's Long-Range Plan, the SR 522 corridor is separate and distinct from the North Corridor primarily as a result of differing travel patterns and is subject to a separate project development process. In addition, because of its location, a Lake City Way/SR 522 alignment is not consistent with the project's Purpose and Need related to transportation effectiveness; therefore, it was eliminated from further consideration.

Rail Operating Concepts

Bus Operating Concepts

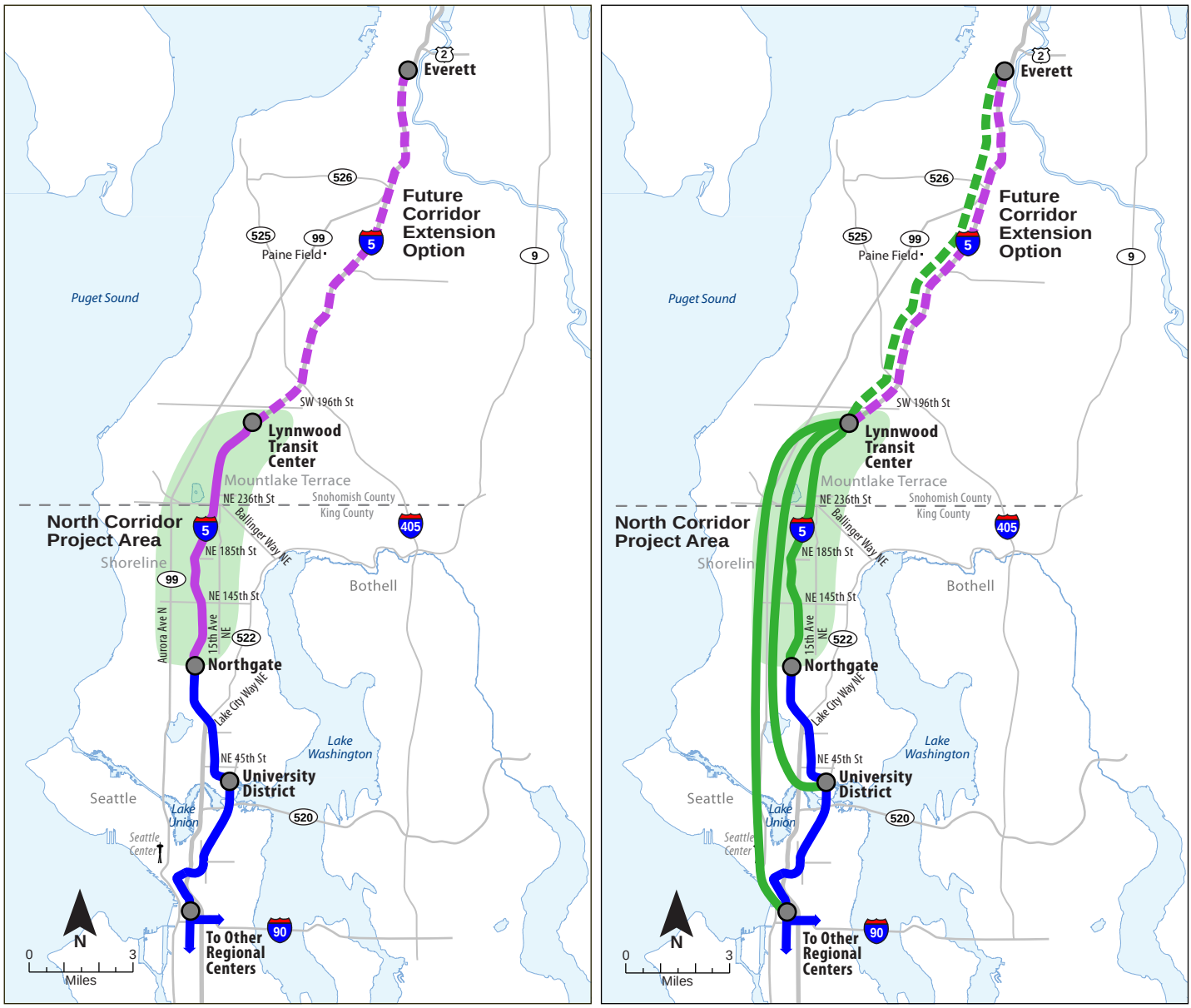


Figure 3-2. Conceptual Operating Strategy for North Corridor Transit Concepts

LIGHT RAIL IN MIXED TRAFFIC

For this concept, light rail would be located at-grade on SR 99 and 15th Avenue NE, operating in mixed general purpose traffic, or mixed with buses in the SR 99 business access and transit (BAT) lanes. During the system plan work leading to the development of both the 1996 voter-approved *Sound Move* (Sound Transit 1996) and 2008 voter-approved ST2 plans, surface light rail operating in mixed traffic was found to have insufficient capacity, slow average speeds, and low reliability. This concept would result in light rail operating more as a streetcar, which is not compatible with the Link light rail system's required train lengths and headways and therefore would not provide reliable service as outlined in Sound Transit's Long-Range Plan.

During preliminary engineering for Central Link, similar concepts were studied for the DSTT and the E3 Busway. Temporary joint operation of bus and rail in the DSTT would work, but it would eventually be converted exclusively to light rail operations once warranted by train headways. A similar operation on the E3 Busway was determined to be unworkable because of frequent at-grade roadway crossings and the trains and buses having to serve different stations. Operation of light rail in the SR 99 BAT lanes would present problems similar to the joint use of the E3 Busway, with the additional problem of mixing rail operations with right-turning general purpose traffic.

Because this concept would have insufficient capacity, slow average speeds, and low reliability, it does not meet the project's Purpose and Need related to transportation effectiveness. As a result, it was eliminated from further consideration.

3.3.4 Initial Concepts Carried Forward for Screening and Development

In addition to a No Build Alternative, eight other initial build concepts were judged promising enough to be screened as part of the development of Level 1 alternatives. These concepts are shown in Figures 3-3, 3-4, and 3-5 and include the following:

No Build Concept: The No Build Concept includes only those improvements committed to and funded for implementation by the transportation providers in the region.

TSM/Baseline Concept: The TSM concept, shown in Figure 3-3, improves the regional transit system in the project area to the greatest extent possible without making a major new capital investment.

Light Rail Concepts (5): Five light rail concepts and sub-concepts were identified to connect Northgate to Lynnwood including an alignment along I-5, two concepts for an alignment along SR 99 (one at-grade and one on elevated structure), and two concepts along 15th Avenue NE (one at-grade and one on an elevated structure). These concepts are illustrated in Figure 3-4.

BRT Concepts (2): Two BRT concepts were developed. One concept focuses on I-5 and attempts to duplicate the I-5 light rail line. The other includes BRT service along three corridors including portions of I-5, SR 99, and 15th Avenue NE.

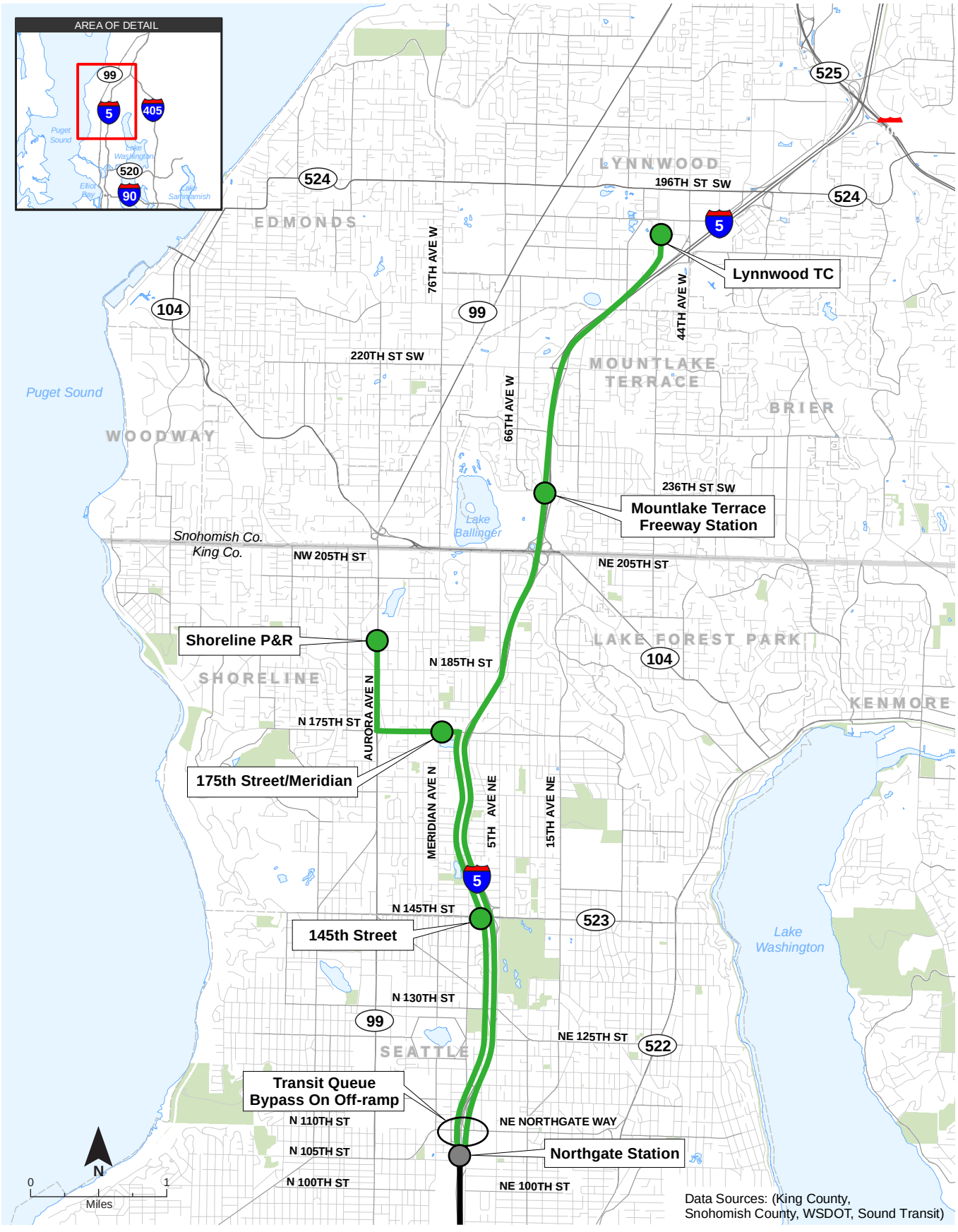


Figure 3-3. TSM/Baseline Concept

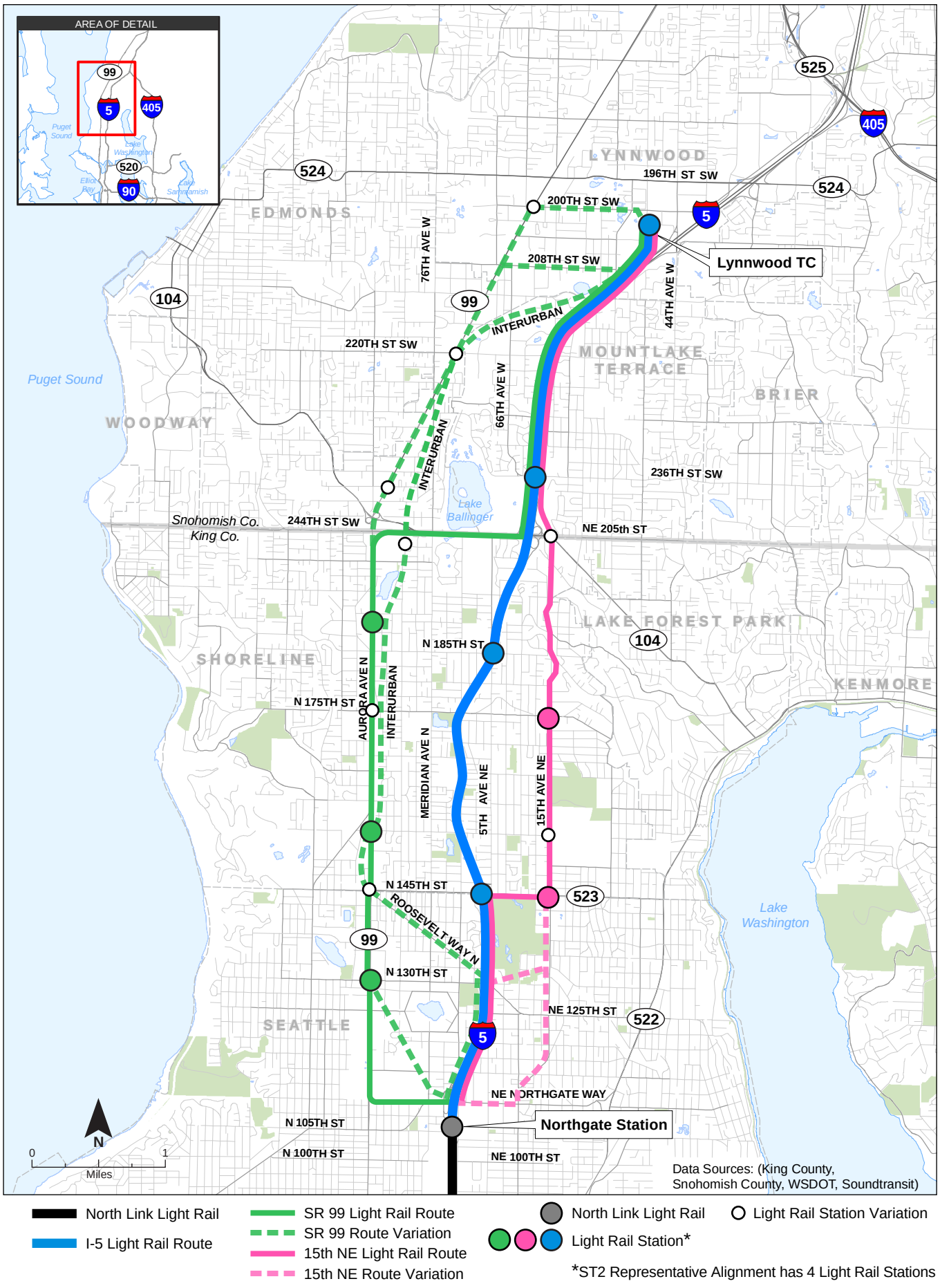


Figure 3-4. Light Rail Concepts

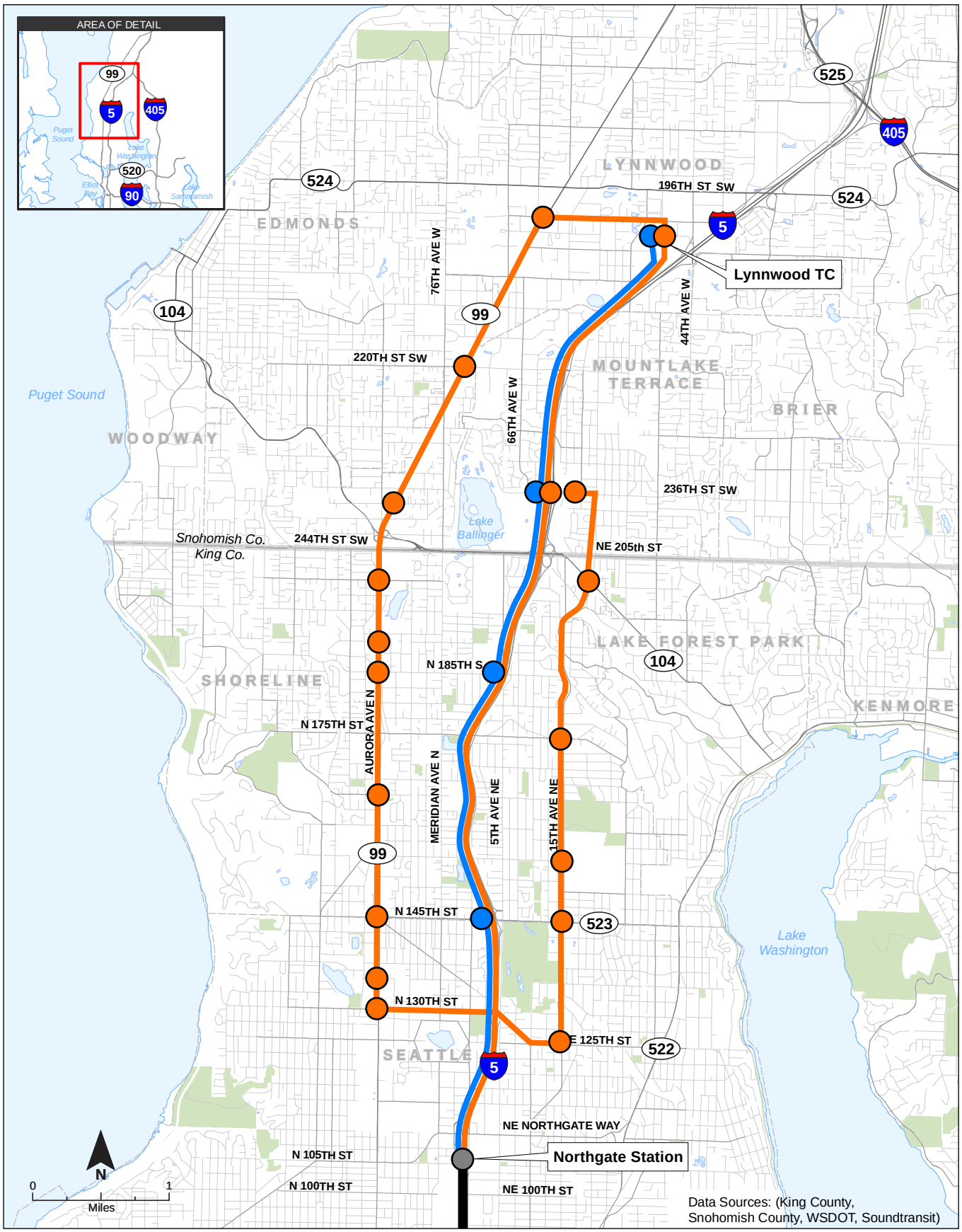


Figure 3-5. BRT Concepts

3.3.5 TSM/Baseline Concept

The intent of the TSM/Baseline Concept is to do the most that can reasonably be done to improve regional mass transit service in the project area with improved bus facilities and services without major new capital investment.

The existing bus network is focused on the peak-period commuter travel markets between the project area and areas to the north, the University District, and downtown Seattle. The bus service additions focus on connecting the project area to the Link light rail network. The following elements would be added to complement existing services:

- A new express bus route would operate in the I-5 HOV lanes between the Lynnwood Transit Center and the Northgate Link Station.
- A second express route would originate at the Shoreline Park-and-Ride and serve areas through Shoreline.
- Five hundred new park-and-ride stalls would be provided at both Shoreline Park-and-Ride and Lynnwood Transit Center.
- Low-cost traffic engineering improvements would be implemented to give buses priority, decrease travel times, and increase reliability between the I-5 Northgate ramps to/from the north and the Link light rail station.

The TSM/Baseline Concept is shown in Figure 3-3.

3.3.6 I-5 Light Rail Concept

The I-5 Light Rail Concept is the same as the representative alignment that was the basis for the project included in the ST2 Plan. This alignment assumes a fully grade-separated, elevated double-track rail line from Northgate to the Lynnwood Transit Center. The I-5 Light Rail Concept is shown in Figure 3-4 and includes the following elements:

- Operation of light rail trains, up to four cars in length, between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes.
- Expansion of the existing light rail vehicle fleet and additional operation and maintenance (O&M) facility capacity sufficient to support the extension.
- Four new light rail stations north of Northgate including stations at NE 145th Street, NE 185th Street, SW 236th Street, and the Lynnwood Transit Center.
- Five hundred new park-and-ride stalls at each of the 145th Street, 185th Street, and Lynnwood Transit Center Link stations.
- Restructured bus services consistent with 2007 bus/light rail service integration of Sound Transit, Community Transit, and King County Metro for ST2.

Variations of this concept could include a combination of elevated and, where feasible, at-grade (in exclusive right-of-way) configurations along I-5, and various combinations of I-5 east side, median, and west side alignments. A number of alternative station locations and configurations are also possible, which are shown in Figure 3-4.

3.3.7 SR 99 Light Rail Concept

For the purpose of concept screening, two representative versions were considered, one at-grade and one elevated along SR 99. Both versions assume operation of light rail trains in its own exclusive right-of-way, whether on aerial structure or at-grade with cross streets. They also assume that adequate right-of-way would be acquired to maintain the existing number of travel lanes on SR 99, including BAT lanes. The two representative versions assume a connection would be made to the SR 99 corridor from Northgate with an elevated alignment along the North 110th Street corridor. The connection back to Lynnwood would be made using the SR 104 and I-5 corridors. The SR 99 Light Rail Concept is shown in Figure 3-4 and includes the following elements:

- Operation of light rail between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes for the fully grade-separated variation, and 8-minute peak, 10-minute off-peak headways for the variation running at-grade along SR 99.
- Five new light rail stations north of Northgate, either elevated or at-grade. Station location variations are shown in Figure 3-4.
- Expansion of the existing light rail vehicle fleet and additional O&M facility capacity sufficient to support the extension.
- Five hundred new park-and-ride stalls at both the Shoreline Park-and-Ride and the Lynnwood Transit Center.
- Restructured bus services to integrate existing service with new light rail service and to avoid duplication.

Figure 3-4 also illustrates the large number of variations that were considered for SR 99. These include three different paths for the connection from Northgate, possible use of portions of the parallel former Interurban right-of-way in King and Snohomish counties, and four options for the connection back to the Lynnwood Transit Center.

3.3.8 15th Avenue NE Light Rail Concept

The 15th Avenue NE Light Rail Concept assumes either a fully elevated alignment, or a mixed elevated/at-grade alignment extending north from the Northgate Link Station generally along 15th Avenue NE to the Mountlake Terrace Transit Center, and from there along I-5 to the Lynnwood Transit Center in an elevated alignment. Both versions assume operation of light rail trains in an exclusive right-of-way, which could be elevated or at-grade with cross streets. For the purposes of the concept development and screening, the representative route follows I-5 from Northgate to North 145th Street in an elevated alignment, and then continues elevated

along North 145th Street east to 15th Avenue NE. North of this point the alignment could be either elevated or at-grade through the North City neighborhood in Shoreline. South of Ballinger Way, the at-grade variation would become elevated again to cross Ballinger Way and the SR 104/I-5 interchange, before connecting into the Mountlake Terrace Transit Center. Variations of this alignment are discussed below. The 15th Avenue NE Light Rail Concept is shown in Figure 3-4 and includes the following elements:

- Operation of light rail between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes for the fully grade-separated option, and 8-minute peak headways and 10-minute off-peak headways for the at-grade option. It is anticipated that 4-minute headways would not be possible to maintain with an at-grade alignment due to the impacts on traffic signal operations at several intersections with high conflicting traffic volumes.
- Expansion of the existing light rail vehicle fleet and additional O&M facility capacity sufficient to support the extension.
- Four new light rail stations north of Northgate (either elevated or at-grade). Station location variations are shown in Figure 3-4.
- Approximately 500 additional park-and-ride stalls at the Lynnwood Transit Center.
- Restructured bus services to integrate existing service with new light rail service and to avoid duplication of transit service on 15th Avenue NE.

Figure 3-4 also illustrates the variations that were considered for connecting from Northgate to 15th Avenue NE. In addition to the representative alignment, these include an alignment along Northgate Way, Roosevelt Way, and Pinehurst Way reaching 15th Avenue NE at NE 117th Street, as well as an alignment along I-5 and NE 130th Street and the southern edge of the Jackson Park Golf Course.

3.3.9 I-5 BRT Concept

The I-5 BRT Concept consists of a BRT line using the I-5 HOV lanes between the existing Northgate and Lynnwood Transit Centers. The BRT line would provide service similar to the I-5 Light Rail Concept, but with modifications to take advantage of the greater routing flexibility possible with roadway-based transit service. As with the TSM/Baseline Concept, existing bus services in the project area would remain in place. The I-5 BRT Concept is shown in Figure 3-5.

Physical improvements to facilitate the BRT line would include the following:

- **Northgate Transit Center:** Transit-only direct access ramps to and from the north would provide direct connections to the I-5 HOV lanes. Three additional in-service bus bays and four bays for layover space would be provided at the Northgate Link Station.
- **NE 145th Street:** Transit-only direct access ramps would be provided between the I-5 HOV lanes and a BRT station located in the northeast quadrant of the interchange.

Park-and-ride, feeder bus access, and other access improvements similar to those included in the I-5 Light Rail Concept would be provided.

- **NE 185th Street:** Direct access ramps would be provided between the I-5 HOV lanes and the NE 185th Street Bridge over I-5, with bus bays located just north of the bridge. Park-and-ride, feeder bus access, and other access improvements similar to those included in the rail alternative would be provided.
- **SW 236th Street:** The newly constructed Mountlake Terrace Freeway Station, which provides all the needed BRT facilities at this location.
- **Lynnwood Transit Center:** Additional park-and-ride capacity similar to that included in the I-5 Light Rail Concept would be provided.
- **Rider Amenities:** Real-time operating information and off-board fare collection would be incorporated at the five BRT stations.

3.3.10 Multi-Corridor BRT Concept

Initially, BRT concepts were considered for each of the alignments within the North Corridor that were considered for light rail concepts. However, it was quickly realized that new BRT service concentrated solely on SR 99 or 15th Avenue NE would perform poorly compared to BRT in I-5. At the same time, developing new bi-directional I-5 HOV lane direct access ramps or freeway stations similar to the new station in Mountlake Terrace presented serious challenges, particularly in the portions of the freeway located in King County. In the areas where the median is insufficient to accommodate these new facilities, the entire freeway would require reconstruction for more than a mile in the vicinity of the new ramps or station. To address these problems the Multi-Corridor BRT Concept, consisting of three BRT lines between the existing Northgate and Lynnwood Transit Centers, was developed. Direct access ramps to and from the north would provide direct connections for transit between the Northgate Transit Center and the I-5 HOV lanes. Additionally, transit direct access ramps to and from the south connecting into the I-5 HOV lanes would be provided at NE 130th Street. As with the TSM/Baseline Concept, existing bus services in the project area focused on the University District and downtown Seattle would remain in place. The three proposed routes comprising this concept are shown in Figure 3-5 and would be designed as follows:

- The SR 99 route would overlay and complement *Swift* and RapidRide E Line service along SR 99 while not replacing either one of those services. The route would use the transit direct access ramps at Northgate to access the I-5 HOV lanes, and then the direct access ramps at NE 130th Street to reach the surface street system. From there the route would travel west on North 130th Street to SR 99, north to 200th Street SW in Snohomish County, and east to the Lynnwood Transit Center. Headways would be 10 minutes during peak periods and 15 minutes during off-peak periods.
- The I-5 route would also use the transit direct access ramps to access the I-5 HOV lanes from Northgate, and continue north on I-5 stopping at the Mountlake Terrace in-line freeway station prior to reaching the Lynnwood Transit Center via the existing HOV

direct access ramp. Headways would be 2 minutes during peak periods and 10 minutes during off-peak periods.

- The 15th Avenue NE route would also use the transit direct access ramps at Northgate to access the I-5 HOV lanes, and then the direct access ramps at NE 130th Street to reach the surface street system. From there the route would travel east on NE 130th Street/NE 125th Street to 15th Avenue NE, and then north on 15th Avenue NE through North City in Shoreline. From North City the route would continue north on 15th Avenue NE and then turn northeast onto NE 196th Street, which transitions to 19th Avenue NE and then 56th Avenue West. Finally, the route would turn west onto 236th Street SW to the Mountlake Terrace Transit Center. Headways would be 15 minutes during peak and off-peak periods.

Physical improvements to facilitate the Multi-Corridor BRT Concept would include the following:

- **Northgate Transit Center:** Transit-only direct access ramps to and from the north would provide direct connections to the I-5 HOV lanes. Additional bus bays and layover space would be provided at the Northgate Link Station. Seven additional in-service bays and eight layover bays would be required to accommodate the anticipated route changes.
- **Mountlake Terrace Transit Center:** One bay for drop-off and one bay for pick-up for one articulated bus and layover space for up to two articulated buses would be required.
- **Lynnwood Transit Center:** Additional park-and-ride capacity similar to that included in the I-5 Light Rail Concept would be provided, including a new 500-stall parking structure. There would also be a need for three additional bus layover spaces.
- **Shoreline Park-and-Ride:** 500 new park-and-ride stalls would be provided.
- **Transit Signal Priority:** Transit signal priority improvements are required at all signals along 15th Avenue NE, 200th Street SW, and North 130th Street. Also, because the existing transit signal priority systems on SR 99 in King and Snohomish counties use different technologies, BRT vehicles would be equipped with both types of technology to use each system.
- **Roadway:** New transit direct access ramps would be provided on I-5 at NE 130th Street to connect into the I-5 HOV lane to/from the south.
- **Stations:** This BRT concept would mostly use existing stations. Six new BRT stations are required, the majority of which would be in the 15th Avenue NE corridor.
- **Rider Amenities:** Real-time operating information and off-board fare collection would be incorporated at BRT stations.

3.4 INITIAL CONCEPT SCREENING RESULTS

This section presents results of the initial screening of alternative concepts. A summary matrix of the screening results is provided in Table 3-4 and the recommendations for the development of the Level 1 alternatives are shown in Table 3-5. More detail on the screening results is provided in the *Level 1 Definition of Alternatives Technical Memorandum (*Sound Transit 2011c*)*. Key findings from this work include the following:

- All of the concepts, other than the 15th Avenue NE Light Rail Concept with the at-grade variation, provide a faster travel time than the TSM/Baseline Concept, with the elevated concepts being the fastest. The I-5 Light Rail Concept provides the shortest travel time as a result of its short length, lack of speed-reducing curves, full grade separation, and only four station stops. Similar results were found for reliability, capacity, and connections to the regional multimodal system.
- The greatest land use and economic development potential was found for the SR 99 Light Rail Concept and the Multi-Corridor BRT Concept, based solely on the larger number of stations provided for each concept.
- Because of the quantity of new construction and possible new transportation right-of-way required, all of the build concepts would result in more potential impacts on the man-made and natural environments than the TSM/Baseline Concept. Because the light rail concepts involve the largest amount of new construction, they are judged to have the most impacts. Of the light rail concepts, the SR 99 and 15th Avenue NE concepts are judged to have the greatest impacts because they would require the largest amounts of new transportation right-of-way.
- The best accessibility to the PSRC-designated Regional Growth Centers would be provided by the I-5, elevated SR 99, and elevated 15th Avenue NE light rail concepts.

As a result of the initial screening, a number of concepts, as well as several concept variations, were dropped from further consideration. The sections that follow discuss the reasons these were dropped from further study.

3.4.1 15th Avenue NE Light Rail Concepts Screened Out

Based on the initial concept screening, the 15th Avenue NE Light Rail Concepts, including the at-grade and elevated variations, were dropped from further consideration in the AA process.

While elevated light rail along 15th Avenue NE meets some of the project's Purpose and Need related to rider benefits and transit capacity, it has no clear transportation advantages over either the I-5 or SR 99 light rail concepts because its accessibility is more limited than the other routes. In addition, the concept would have potentially serious impacts to the local communities through which it would pass.

Table 3-4. Initial Concept Review and Screening Summary

	TSM/ BASELINE	I-5 Light Rail	SR 99 Light Rail (Elevated)	SR 99 Light Rail (At-Grade)	15th Ave Light Rail (Elevated)	15th Ave Light Rail (At-Grade)	I-5 BRT	I-5 + SR 99 + 15th Ave NE BRT
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access and Capacity Needs								
Travel Time								
Reliability • Miles on non-exclusive guideway • Number of signalized intersections traversed								
Capacity								
Connections to Regional Multimodal System								
Peak period travel times between Lynnwood and selected regional growth centers								
Number of regional growth centers reachable via a one-seat ride								
Purpose and Need: Equitable Community Impacts and Benefits								
Not considered for concept screening.								
Purpose and Need: Supportive Land Use and Economic Development Effects								
Land Use and Economic Development Potential: Number of activity centers within 1/2 mile of alignment								
Purpose and Need: Preservation of a Healthy Environment								
Right-of-way Impacts								
Community Impacts								
Transportation System Impacts								
Purpose and Need: Cost and Constructability								
Cost: Extraordinary cost considerations								
Purpose and Need: Consistency with Sound Transit Long-Range Vision								
Not considered for concept screening.								

Table 3-5. Recommended Level 1 Alternatives

Alternative carried forward. Alternative dropped.

Level 1 Alternatives	Reasons for Advancing or Dropping Alternative	Recommended Level 1 Refinements
TSM/ BASELINE	Required by FTA for New Starts comparisons	Enhance based on findings of BRT alternatives development and evaluation
I-5 Light Rail	• Best performing on all transportation effectiveness measures • Lower right-of-way impacts compared to other light rail alternatives • Lower community impacts compared to other light rail alternatives • Lower transportation system impacts compared to other light rail alternatives	• Consider options to bring some stations and portions of alignment down to grade to reduce impacts and improve affordability • Work with WSDOT to optimize tradeoffs between acquiring new right of way and minimizing impacts to I-5
SR 99 Light Rail (Elevated)	• Transportation effectiveness of elevated alternative superior to at-grade • Highest land use and economic development potential of alternatives • Fully elevated most costly of all alternatives	Consider options to mix elevated with at-grade alignment in selected sections to improve affordability over an all-elevated concept and to reduce impacts and improve travel times of at-grade concept
SR 99 Light Rail (At-Grade)	• Fully at-grade has highest transportation system impacts of all alternatives • Fully at-grade has very large right-of-way impacts	
15th Ave Light Rail (Elevated)	• Transportation effectiveness equal or worse than other light rail alternatives • High right-of-way impacts compared to other light rail alternatives • High community impacts compared to other light rail alternatives • Elevated guideway and stations along 15th would significantly alter the environment in the corridor and impact large numbers of residents and businesses	Drop from further consideration
15th Ave Light Rail (At-Grade)	• Least effective from a transportation standpoint of all light rail alternatives • Travel times longer than Baseline • High right-of-way impacts compared to other light rail alternatives • High community impacts compared to other light rail alternatives • At-grade guideway and stations along 15th would significantly alter the environment and displace large numbers of residents and businesses	Drop from further consideration
I-5 BRT	• Travel time slightly shorter than Baseline • Lower cost than light rail alternatives • Limited right-of-way, transportation, environmental impacts	• Ridership forecasting analysis needed to distinguish between the 2 BRT options • Further work with WSDOT needed to determine design, cost, and impacts of I-5 BRT stations and direct access ramps
I-5 + SR 99 + 15th Ave NE BRT	• Proximity to a high number of activity centers • Shorter travel time than Baseline • Limited right of way, transportation, environmental impacts	

In particular, the 15th Avenue NE Elevated Light Rail Concept does not meet the project's Purpose and Need related to supporting the region's adopted land use vision, promoting the well-being of people and communities, and preserving a healthy environment for the following reasons:

- High right-of-way impacts would occur to both residential and commercial properties. Right-of-way needs would affect approximately 175 to 300 properties with residential and neighborhood commercial uses, including approximately 75 to 100 full acquisitions. In station areas and at intersections, properties on both sides of the street could be removed.
- The scale of a roughly 30-foot-wide aerial guideway, with 400-foot-long and up to 60-foot-wide aerial stations placed on an arterial in the fabric of an existing mixed-use, built-up neighborhood, would have a high potential to affect neighborhood character and function.
- The alignment could adversely affect one or more parks, including the Jackson Park Golf Course, and some historic-era properties.
- The potential exists for noise impacts to a substantial number of residences and other sensitive receptors, including the Fircrest School for the Developmentally Disabled.
- Substantial traffic operations and access impacts would occur along 15th Avenue NE, requiring the limiting of left turns and major widening of several intersections.

An at-grade light rail along 15th Avenue NE, while avoiding some of the impacts of large aerial structures, would perform poorly from a transportation standpoint. Capacity is roughly half of that for the grade-separated light rail and travel times are the longest of all the concepts. At-grade light rail on 15th Avenue NE would be limited to the posted 30-mph speed limit and would be slower than the TSM Baseline Concept. Thus, the 15th Avenue NE At-Grade Light Rail Concept does not meet Purpose and Need related to providing reliable, rapid, and efficient two-way peak and off-peak transit service.

In addition, the concept would have the potential for substantial impacts to the local communities through which it would pass. In particular, the 15th Avenue NE At-Grade Light Rail Concept does not meet the project's Purpose and Need related to supporting the region's adopted land use vision, promoting the well-being of people and communities, and preserving a healthy environment for the following reasons:

- This concept would have the highest right-of-way impacts of all concepts considered, displacing a high number of both residential and commercial properties. Right-of-way needs require 40 to 70 additional feet along the existing roadway affecting at least 300 residential and neighborhood commercial properties, including approximately 175 to 200 full acquisitions.
- The alignment would affect one or more parks, including the Jackson Park Golf Course, and some historic-era properties.

- There is potential for noise impacts to a substantial number of residences and other sensitive receptors, including the Fircrest School for the Developmentally Disabled.
- Substantial traffic operations and access impacts would occur along 15th Avenue NE, requiring the limiting of left turns and major widening of several intersections.

3.4.2 SR 99 Fully At-Grade Light Rail Alignment Screened Out

A fully at-grade configuration along SR 99 between North 130th Street and the King/Snohomish County line does not adequately meet the project's Purpose and Need for the following reasons:

- Travel times from Lynnwood to Northgate would be similar to the TSM/Baseline Concept; however, this variation would require a substantial investment with respect to both infrastructure and right-of-way acquisition. The travel times also would be much longer than they would with an elevated light rail. As such, the fully at-grade variation would not perform well with respect to providing a relatively fast trip between regional centers.
- This variation would have multiple at-grade intersections to navigate, making it less reliable than fully grade-separated elevated options.
- This variation would have high right-of-way impacts in terms of property acquisitions needed for implementation.
- The impact on traffic at high-volume SR 99 intersections would be significant.

As a result, this variation was not carried forward as a stand-alone option. Instead, only the most feasible portions for using at-grade light rail were considered for integration into the Level 1 SR 99 Light Rail Alternative.

3.4.3 SR 99 Light Rail Sub-Alternative Alignments Screened Out

The 130th Street Tunnel and the Interurban Right-of-Way variations to the SR 99 Light Rail Concept also do not adequately meet the project's Purpose and Need and were not considered further.

130th Street Tunnel. The 130th Street Tunnel variation would not allow an at-grade station in the vicinity of North 130th Street and SR 99—a stated objective of the City of Seattle. Because both the North 110th Street and Roosevelt Way variations appear possible to construct without tunnels and perform equally or better, this variation was dropped from further consideration. However, should further conceptual design conclude that a tunnel alignment is required, the North 130th Street Tunnel may be reconsidered.

Former Interurban Right-of-Way. Development of a light rail alignment in the former Interurban right-of-way would require accommodating the existing and future electrical utility transmission line needs, as well as reconstruction of the newly constructed pedestrian and bicycle trail. Adding light rail would require legal agreements with the public power utilities.

These agreements are likely to be difficult to obtain given the utilities' competing needs for expansion and unconstrained access to their current and future electrical power infrastructure and their pre-existing primary public use of the right-of-way.

Although ownership of the trail varies along the trail's full course within King and Snohomish counties, the right-of-way is consistently owned by public entities, and it is presumed to qualify as a Section 4(f) resource. Section 4(f) is a regulation that restricts FTA's ability to approve projects with major uses of recreation and park lands, particularly when other reasonable alternatives are available. In addition to the likely impacts to the Interurban Trail and its bicycle and pedestrian uses, a number of other uses are immediately adjacent. Many of these are residential, and some portions of the right-of-way appear to have been developed with other commercial and residential uses, which increases the potential for property impacts, as well as noise, vibration, and visual impacts. Based on the concept screening analysis, maintaining all the current uses of the existing right-of-way would be challenging and would likely require the acquisition of substantial additional right-of-way.

Finally, following the Interurban right-of-way to Lynnwood would not allow stations at Mountlake Terrace along I-5 nor would it serve much of the SR 99 corridor; therefore, its mobility benefits would be much less than other alignments. As a result, given that other reasonable alignments that perform as well or better are available, an alignment that requires continuous use of large segments of the Interurban right-of-way was dropped from consideration based on the findings from the initial screening. It is possible that using smaller portions of the right-of-way could be reconsidered if sections of a SR 99 route prove more difficult, but not as a major route alignment option.

3.5 LEVEL 1 ALTERNATIVES DEFINITION

Following the screening of the long list of initial alternative concepts, two primary light rail alternatives and two primary BRT alternatives, along with the TSM/Baseline Alternative and the No Build Alternative, were identified for further development and evaluation in the Level 1 analysis. Each of the light rail and BRT alternatives include several sub-alternatives.

3.5.1 Elements Common to All Alternatives

The following assumptions and guiding principles were used in the development of the alternatives:

- Alternatives were defined for the design year 2030.
- Alternatives serve as transit extensions to the Link light rail system that will end at Northgate when the current committed projects are completed by Sound Transit. As such, the alternatives addressed the Northgate-Lynnwood project area only; no improvements for the existing and committed regional transit system south of Northgate were identified.

- Build alternatives focused on the same key travel markets, providing similar accessibility (stations, parking, and access) and levels of service (time span and headways) to make them as comparable as possible.
- Future operational changes to the HOV lanes on I-5 are subject to action by the Washington State Legislature and cannot be known. Therefore, the base assumption for all alternatives was continued 2+ HOV operation. However, *Transportation 2040* calls for eventual development of managed lanes along this portion of I-5. WSDOT is considering a number of options that could result in major reconstruction and tolling of portions of the freeway to include one or more managed lanes in each direction of I-5 between Northgate and Lynnwood. At this time the design, construction costs, right-of-way, transportation system, and environmental impacts of these improvements are not known. To assess how the performance of the I-5 BRT Alternative might be enhanced by these improvements, an option was tested that assumed the managed lanes would achieve an average speed of 45 mph.
- Community Transit and King County Metro bus service growth was assumed to be flat (except for a 0.5 percent per year increase for scheduled maintenance hours) between fall 2009 and 2030 due to service reductions caused by the 2008 to 2010 recession and slow recovery from that recession through 2030.

3.5.2 No Build Alternative

The No Build Alternative included only those improvements committed and funded for implementation by the transportation providers in the region. This alternative assumed that the light rail system extensions approved by voters in 2008 are completed to Northgate, Overlake, and Redondo/Star Lake. The most significant changes in existing transit services in the project area include King County Metro's planned revisions once light rail reaches Northgate and the implementation of RapidRide E Line, which will connect Shoreline with downtown Seattle in 2013 along SR 99. Chapter 4 includes a more detailed description of the No Build Alternative.

3.5.3 TSM/Baseline Alternative

The Level 1 TSM/Baseline Alternative is the same as the initial TSM/Baseline Concept. The intent of this alternative is to do the most that can reasonably be done to improve transit service in the project area with improved bus facilities and services without major new capital investment. The TSM/Baseline Alternative is described in more detail in the previous Section 3.3.5 and illustrated in Figure 3-3.

3.5.4 L1: I-5 Light Rail Alternative

The L1: I-5 Light Rail Alternative advanced to the Level 1 evaluation is the representative alignment that formed the basis of the project described in the ST2 Plan, and is the same as the L1: I-5 Light Rail Concept assessed as part of the initial concept screening. This alignment assumed a fully elevated double-track rail line from Northgate to the Lynnwood Transit Center

with intermediate elevated stations at NE 145th Street, NE 185th Street, and SW 236th Street. The L1: I-5 Light Rail Alternative assumed operation of light rail trains, with up to four cars, between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes. The alternative is described in more detail in the previous Section 3.3.6 and illustrated in Figure 3-6.

3.5.5 L2: SR 99 Light Rail Alternative

The L2: SR 99 Light Rail Alternative is a hybrid concept designed to reduce the right-of-way impacts and improve the speed of the fully at-grade concept, while lowering the costs of the fully elevated light rail concept initially studied. This alternative would operate within an exclusive right-of-way, which could be at-grade in some locations, while other locations require elevating the alignment through major intersections to reduce impacts to traffic operations. This alternative includes five new light rail stations—at-grade light rail stations located at 130th Street and 155th Street, and elevated light rail stations at the Shoreline Park-and-Ride (192nd Street), Mountlake Terrace Transit Center, and Lynnwood Transit Center. Figure 3-7 illustrates the L2: SR 99 Light Rail Alternative. Operation of light rail was assumed between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes, and off-peak headways of 10 minutes.

During concept development, a number of alignment sub-alternatives were identified for the L2: SR 99 Light Rail Alternative. Several were screened out while others were retained for possible consideration. Those retained are shown in Figure 3-7 and include one sub-alternative for connecting from the Link terminus at Northgate to SR 99 in Seattle and one sub-alternative for connecting from SR 99 back to the Lynnwood Transit Center. These sub-alternatives were assessed during initial screening and it was concluded that the primary alternative alignment shown in Figure 3-7 was the most promising and should be used as the representative alignment for the L2: SR 99 Light Rail Alternative during the Level 1 evaluation process.

3.5.6 B1: I-5 BRT Alternative

This alternative is the same as the I-5 BRT Concept, described in more detail in Section 3.3.9, which was assessed as part of the initial concept screening. The B1: I-5 BRT Alternative consists of a BRT line using the I-5 HOV lanes between the existing Northgate and Lynnwood Transit Centers. The BRT line would be designed to provide service similar to the rail extension, but with slight service modifications to take advantage of the greater routing flexibility possible with roadway-based transit service. As with the TSM/Baseline Alternative, existing bus services in the project area focused on the University District and downtown Seattle would remain in place. Transit-only direct access ramps connecting new BRT stations to the I-5 HOV lanes would be built at Northgate, NE 145th Street, and NE 185th Street. Park-and-ride, feeder bus access, and other access improvements similar to those included in the I-5 Light Rail Alternative would be provided, including new 500-stall parking structures at the NE 145th Street, NE 185th Street, and Lynnwood Transit Center stations. The B1: I-5 BRT Alternative is shown in Figure 3-8.

3.5.7 B2: Multi-Corridor BRT Alternative

The B2: Multi-Corridor BRT Alternative consists of three BRT lines serving each of the major north-south roadways between the existing Northgate and Lynnwood Transit Centers. This alternative is the same as the Multi-Corridor BRT Concept assessed as part of the initial concept screening and described in greater detail in Section 3.3.10. Direct access ramps to and from the north would provide direct connections for transit between the Northgate Transit Center and the I-5 HOV lanes. Additionally, transit direct access ramps to and from the south connecting into the I-5 HOV lanes would be provided at NE 130th Street. As with the TSM/Baseline Alternative, existing bus services in the project area focused on the University District and downtown Seattle would remain in place. The three proposed routes comprising this alternative are shown in Figure 3-9 and would run along SR 99, I-5, and 15th Avenue NE.

3.6 LEVEL 1 ALTERNATIVES EVALUATION

The Level 1 alternatives were evaluated based on criteria and performance measures derived from the project's Purpose and Need. Detailed results of this evaluation are contained in the *North Corridor Transit Project Level 1 Alternatives Analysis and Evaluation Report* (Sound Transit 2011a).

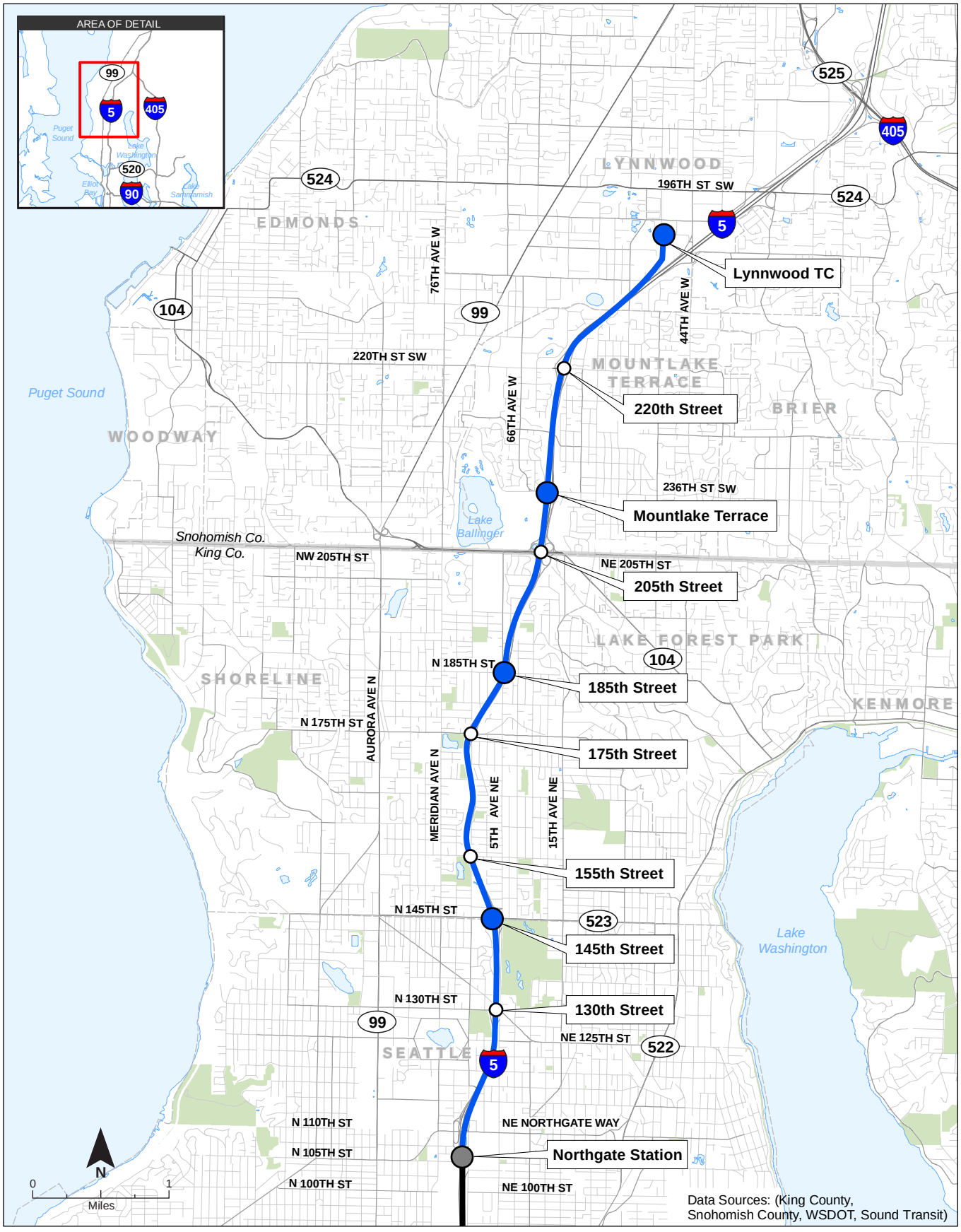
The North Corridor Transit Project's Purpose and Need can be summarized into six broad categories as follows:

- Transportation effectiveness
- Community equity
- Land use and economic development effects
- Environmental performance
- Cost and constructability
- Consistency with Sound Transit's long-range vision

3.6.1 Transportation Effectiveness

Transportation effectiveness was evaluated based on measures related to the following four overarching criteria:

- Transit ridership
- Ability to accommodate demand (passenger-carrying capacity)
- Transit travel times
- Transit trip reliability



Light Rail Route
North Link Light Rail
Proposed Light Rail Station*
North Link Station
Potential Light Rail Station Variation
*ST2 Representative Alignment has 4 Light Rail Stations

Figure 3-6. L1: Level 1 I-5 Light Rail Alternative

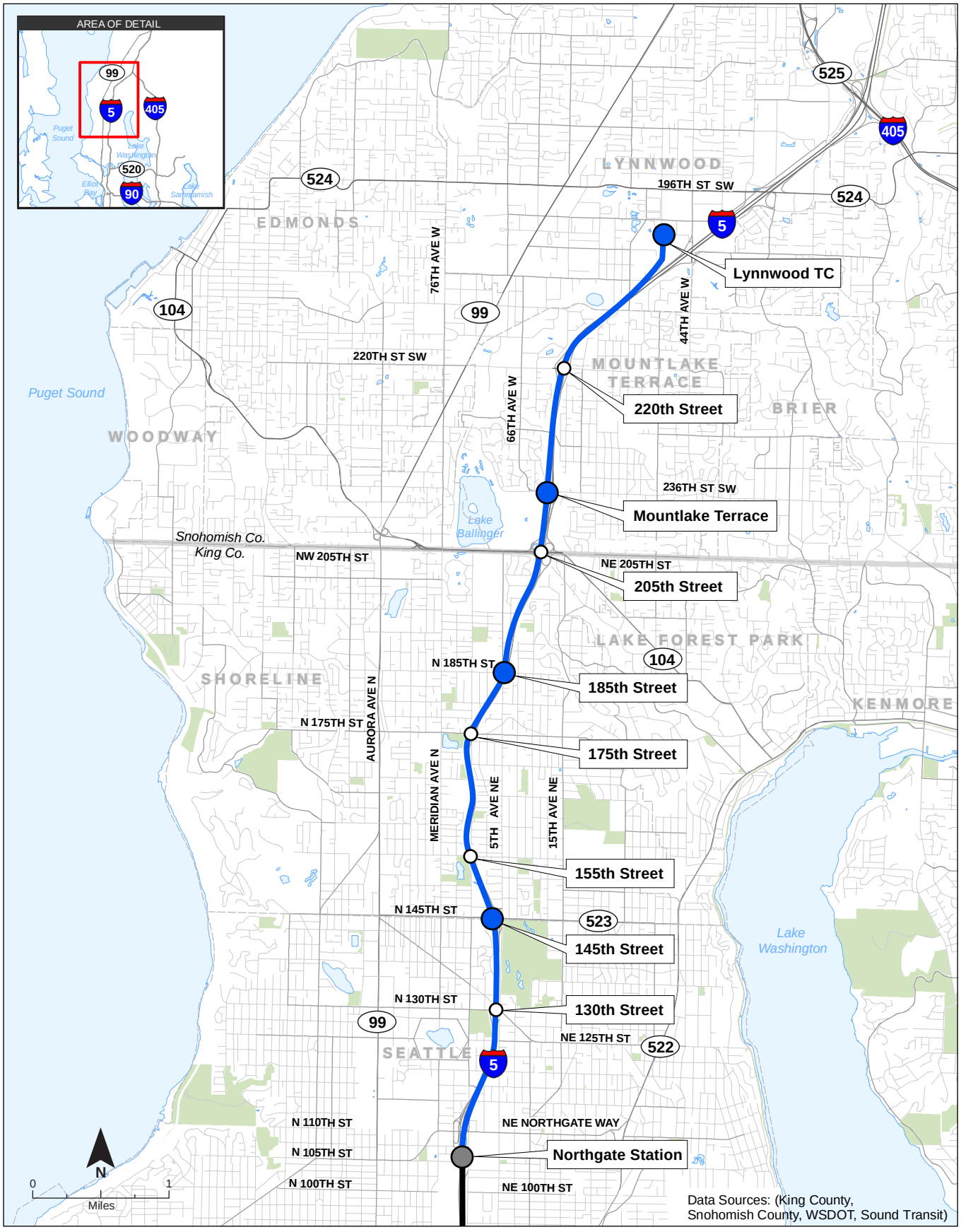


Figure 3-7. L1: Level 1 I-5 Light Rail Alternative

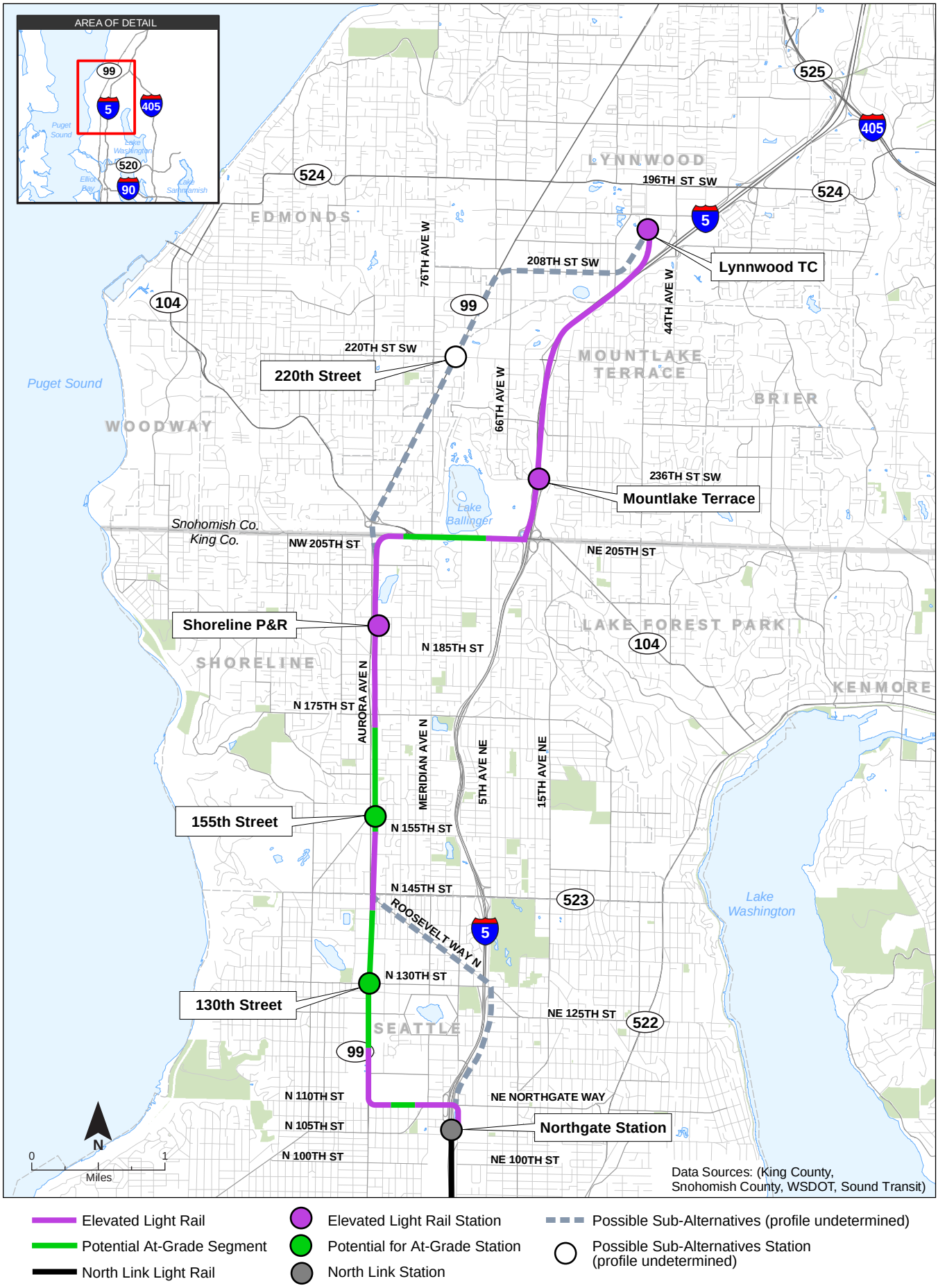


Figure 3-8. L2: Level 1 SR 99 Light Rail Alternative

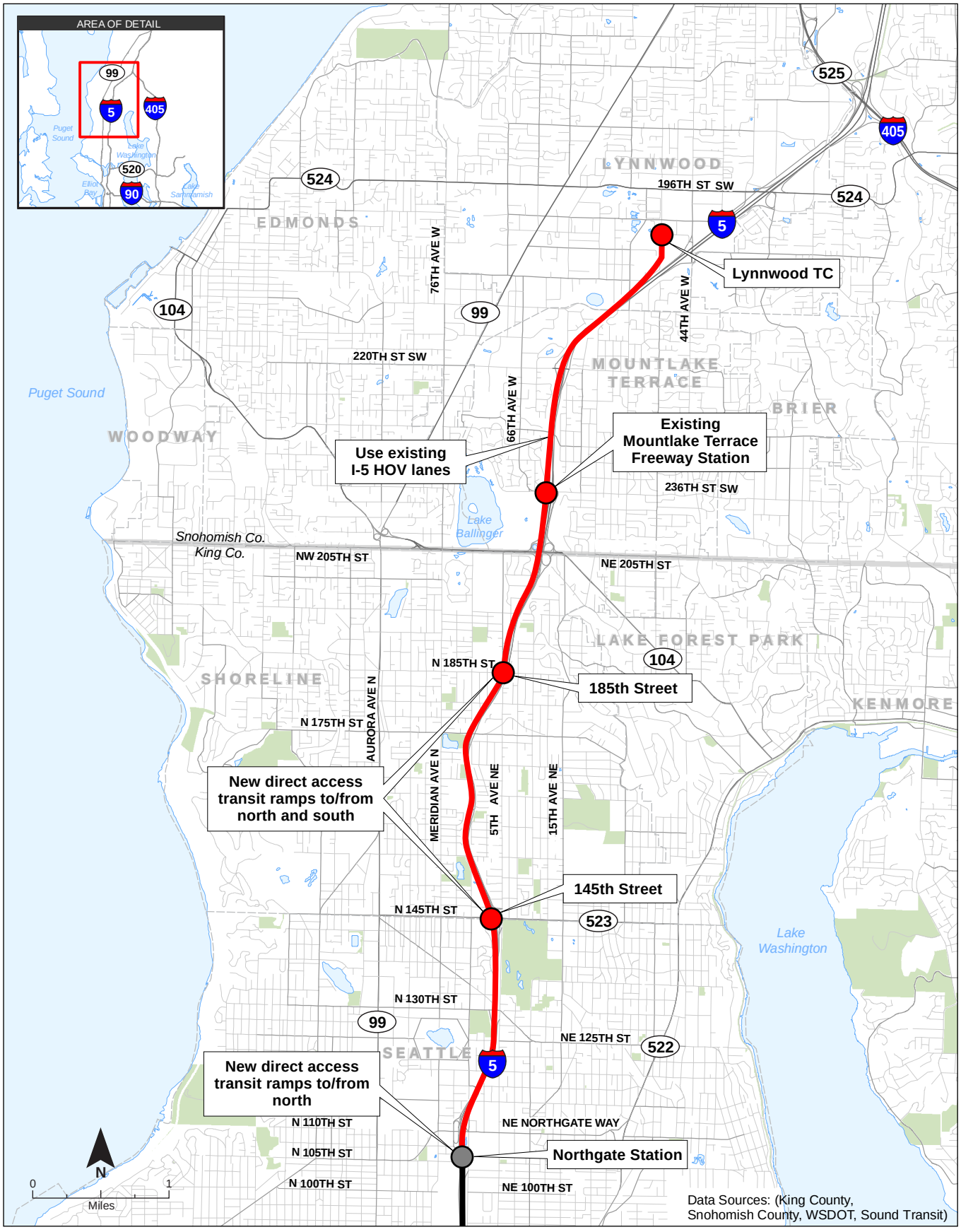


Figure 3-9. B1: Level 1 I-5 BRT Alternative

TRANSIT RIDERSHIP

Sound Transit's Regional Transit Ridership Forecasting Model was used to generate year 2030 forecasts of transit ridership, as well as annual new riders and user benefits as measured by annual hours of travel time savings (Sound Transit 2010d; Sound Transit 2010e).

All of the North Corridor Transit Project alternatives increase system-wide ridership over the Sound Transit model's projection of 506,000 total daily transit trips in 2030 with the No Build Alternative. As shown in Table 3-6, the light rail alternatives show the highest increase in total system transit use, with L1: I-5 Light Rail Alternative being the highest, with approximately twice the ridership forecasted for the BRT alternatives. The result for the TSM/Baseline Alternative is half of that for the BRT alternatives.

Similar results, illustrated in Table 3-6, are seen for project daily riders, annual new riders, and user benefits, with the light rail alternatives showing more than double the ridership and user benefits as the BRT alternatives.

Table 3-6. 2030 Transit Ridership Forecasting Model Output Summary

Alternative	Project Average Weekday Riders	Annual System-wide New Riders*	User Benefits – Annual Hours of Travel Time Saved*
TSM/Baseline	13,400	0.98 million	0.83 million
L1: I-5 Light Rail	50,600	5.9 million	5.9 million
L2: SR 99 Light Rail	46,200	5.2 million	4.9 million
B1: I-5 BRT	20,800	2.2 million	1.9 million
B2: Multi-Corridor BRT	25,100	2.6 million	2.3 million

*Compared to the No Build Alternative

For the B1: I-5 BRT Alternative, a sensitivity analysis was undertaken to test the potential ridership impacts of improved I-5 operations assuming development of managed lanes capable of maintaining average operating speeds of 45 mph during peak periods. This is compared to an assumed 35 mph in the base case with the existing HOV lanes and additional direct access ramps. With the assumption of improved speed, the overall year 2030 average weekday regional transit ridership increases by about 1,700 trips compared to the base B1: I-5 BRT Alternative. This represents an annual increase of about 0.5 million new riders or about 24 percent over the 2.2 million annual new riders associated with the B1: I-5 BRT Alternative. Transit user benefits, which are a function of new riders, would also increase by about 24 percent.

ABILITY TO ACCOMMODATE DEMAND

The light rail alternatives provide the highest capacity of passengers per hour per direction. BRT alternatives provide more than twice the capacity of the TSM/Baseline Alternative, but only a quarter of the capacity of the light rail alternatives. A summary of approximate practical hourly passenger capacity by alternative is provided in Table 3-7. Light rail capacity is based on

the assumed peak hour headway of 4 minutes, with 4-car trains. Bus capacity is determined based on the capacity of the bus facilities at the Northgate Link light rail station.

Table 3-7. 2030 Practical Person-Carrying Capacity

Alternative	Passengers per Hour per Direction
TSM/Baseline Alternative	1,260
L1: I-5 Light Rail Alternative	8,840
L2: SR 99 Light Rail Alternative	8,840
B1: I-5 BRT Alternative	2,700
B2: Multi-Corridor BRT Alternative	2,700

TRANSIT TRAVEL TIMES

Estimated 2030 transit travel times from Lynnwood and Shoreline to representative Regional Growth Centers, as defined by PSRC, are shown in Tables 3-8 through 3-11. Estimated travel times shown in these tables include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate. Also, where the travel time for the build alternative is greater than the No Build travel time, the No Build is assumed instead.

All of the alternatives provide shorter travel times compared to the No Build, with the shortest being the L1: I-5 Light Rail Alternative. Peak direction travel times from Lynnwood for Alternative L2: SR 99 Light Rail and the BRT alternatives are approximately 7 to 11 minutes longer than Alternative L1. Off-peak direction travel times, which are different for buses because of different expected travel speeds, are included because congestion in the North Corridor is known to exist in both directions during peak periods, particularly during the PM peak period. Light rail travel times, which are unaffected by traffic conditions, are the same between peak and off-peak periods.

Table 3-8. 2030 Transit Peak-Period, Peak-Direction Travel Times (minutes) from Lynnwood to Regional Growth Centers

Alternative	Northgate	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	60	41	52	43	88	49	68
TSM/Baseline	28	35	39	43	75	49	68
L1: I-5 Light Rail	14	21	25	29	61	49	68
L2: SR 99 Light Rail	21	28	32	36	68	49	68
B1: I-5 BRT	25	32	36	40	72	49	68
B2: Multi-Corridor BRT	24	31	35	39	71	49	68

Note: Estimated 2030 travel times are via the shortest light rail, bus or bus and light rail connection and include dwell times at stations and, for some alternatives and trip pairs, transfer time from bus to rail at Northgate.

Table 3-9. 2030 Transit Peak-Period, Off-Peak Direction Travel Times (minutes) from Lynnwood to Regional Growth Centers

Alternative	Northgate	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	55	51	77	44	89	55	81
TSM/Baseline	22	29	33	37	69	55	71
L1: I-5 Light Rail	14	21	25	29	61	52	63
L2: SR 99 Light Rail	21	28	32	36	68	55	70
B1: I-5 BRT	19	26	30	34	66	55	68
B2: Multi-Corridor BRT	18	25	29	33	65	55	67

Note: Estimated 2030 travel times are via the shortest light rail, bus or bus and light rail connection and include dwell times at stations and, for some alternatives and trip pairs, transfer time from bus to rail at Northgate.

Table 3-10. 2030 Transit Peak-Period, Peak-Direction Travel Times (minutes) from Shoreline to Regional Growth Centers

Alternative	Northgate	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	36	66	45	33	74	76	89
TSM/Baseline	32	39	43	33	74	70	81
L1: I-5 Light Rail	7	14	18	22	54	45	56
L2: SR 99 Light Rail	11	18	22	26	58	49	60
B1: I-5 BRT	15	22	26	30	62	53	64
B2: Multi-Corridor BRT	26	33	37	33	73	64	75

Note: Estimated 2030 travel times are via the shortest light rail, bus or bus and light rail connection and include dwell times at stations and, for some alternatives and trip pairs, transfer time from bus to rail at Northgate.

Table 3-11. 2030 Transit Peak-Period, Off-Peak Direction Travel Times (minutes) from Shoreline to Regional Growth Centers

Alternative	Northgate	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	41	71	79	42	87	92	81
TSM/Baseline	27	34	38	42	74	65	76
L1: I-5 Light Rail	7	14	18	22	54	45	56
L2: SR 99 Light Rail	11	18	22	26	58	49	60
B1: I-5 BRT	12	19	23	27	59	50	61
B2: Multi-Corridor BRT	23	30	34	38	70	61	72

Note: Estimated 2030 travel times are via the shortest light rail, bus or bus and light rail connection and include dwell times at stations and, for some alternatives and trip pairs, transfer time from bus to rail at Northgate.

TRANSIT RELIABILITY

Two measures were used as surrogates for reliability for the Level 1 evaluation—the miles of operation in non-exclusive right-of-way and the number of signalized intersections traversed.

Non-Exclusive Guideway

Both of the light rail alternatives operate on completely exclusive guideway, regardless of whether they are elevated or at-grade. The bus-based alternatives operate predominantly in non-exclusive right-of-way in the HOV lanes, BAT lanes, or along arterials. The B1: I-5 BRT Alternative involves less non-exclusive guideway compared with the TSM/Baseline Alternative, due to the use of transit-only direct access ramps. The B2: Multi-Corridor BRT Alternative operates on the greatest number of miles of non-exclusive guideway due to the combined length of its three routes. Although the I-5 HOV lanes and SR 99 BAT lanes are operating on a non-exclusive guideway, the lanes do offer a level of priority that provides some reliability benefit over general purpose lanes. Table 3-12 provides a summary of miles of non-exclusive guideway.

Table 3-12. Miles of Operation on Non-Exclusive Guideway

Alternative	Miles of Operation on Non-Exclusive Guideway
TSM/Baseline Alternative	14.0
L1: I-5 Light Rail Alternative	0
L2: SR 99 Light Rail Alternative	0
B1: I-5 BRT Alternative	8.3
B2: Multi-Corridor BRT Alternative	25.8

Number of At-Grade Signalized Intersections Traversed

The L1: I-5 Light Rail Alternative would not traverse any at-grade signalized intersections, while the L2: SR 99 Light Rail Alternative would traverse several at-grade intersections. The number of at-grade signalized intersections traversed for each alternative is provided in Table 3-13. With direct access into and out of the Northgate Transit Center, the B1: I-5 BRT Alternative would not traverse any at-grade intersections, while the B2: Multi-Corridor BRT Alternative includes 45 at-grade intersections traversed on the SR 99 and 15th Avenue NE corridors.

Table 3-13. Number of At-Grade Signalized Intersections Traversed

Alternative	Number of At-Grade Signalized Intersections Traversed
TSM/Baseline Alternative	9
L1: I-5 Light Rail Alternative	0
L2: SR 99 Light Rail Alternative	7
B1: I-5 BRT Alternative	0
B2: Multi-Corridor BRT Alternative	45

3.6.2 Community Equity

This evaluation measure assessed each alternative's ability to avoid disproportionate impacts to low-income or minority communities, and to provide an equitable distribution of project or environmental benefits to these communities compared to the general population.

Tables 3-14 and 3-15 provide both the percentage and the estimated population counts of low-income and minority populations that would be considered likely to experience impacts or benefits (with all stations or alignment areas combined). The demographic characteristics of King and Snohomish counties were used as the baseline to evaluate whether a low-income or minority population in the station or alignment buffer areas had a higher level of representation than the general population.

Table 3-14. Year 2000 Low-Income and Minority Populations within 0.5 Mile of Alignments

Alternative	Estimated Total Population	Estimated Low-Income Population	Estimated Minority Population
Two-County Area	2,343,058	183,570 (8.0%)	562,733 (24.0%)
TSM/Baseline	37,909	3,266 (8.6%)	13,034 (34.4 %)
L1: I-5 Light Rail	30,978	2,512 (8.1%)	10,832 (35.0%)
L2: SR 99 Light Rail	40,533	4,201 (10.4%)	14,315 (35.3%)
B1: I-5 BRT	30,978	2,512 (8.1%)	10,832 (35.0%)
B2: Multi-Corridor BRT	51,196	8,000 (15.6%)	26,879 (52.5%)

Source: 2000 Census data (U.S. Census Bureau 2000)

Table 3-15. Year 2000 Low-Income and Minority Populations within 0.5 Mile of Station Areas

Alternative	Estimated Total Population	Low-Income Population	Minority Population
Two-County Area	2,343,058	183,570 (8.0%)	562,733 (24.0%)
TSM/Baseline	17,697	1,426 (8.1%)	5,714 (32.3 %)
L1: I-5 Light Rail	13,080	884 (6.8%)	4,159 (31.8%)
L2: SR 99 Light Rail	14,925	1,235 (8.3%)	4,927 (33.0%)
B1: I-5 BRT	13,080	884 (6.8%)	4,159 (31.8%)
B2: Multi-Corridor BRT	60,736	6,270 (10.3%)	19,660 (32.4%)

Source: 2000 Census data (U.S. Census Bureau 2000)

The 2000 U.S. Census data were used for this analysis, which was completed in early 2001; as the project proceeds into later evaluations and the EIS, year 2010 Census information will be used as it becomes available. The demographic analysis found that the five alternatives being considered had generally similar percentages of low-income and minority populations along their alignments compared to the general population in King and Snohomish counties. However, a higher number of low-income and minority persons were found along the alignments for the L2: SR 99 Light Rail and B2: Multi-Corridor BRT Alternatives, largely because these areas are more heavily populated than areas along the I-5 alignment.

The estimated representation of low-income and minority populations in the alternative station areas show a similar pattern. Of the five alternatives, the B2: Multi-Corridor BRT Alternative would place stations near the greatest numbers of low-income and minority persons. This is because the alternative is composed of three alignments and 17 stations that would have some level of transit improvements; however, in percentage terms the representation of low-income and minority populations remain similar to the other alternatives. All five alternatives would have station areas that are near populations with a higher percentage of minority persons compared to the population of the two-county area.

3.6.3 Land Use and Economic Development

For the Level 1 evaluation, the measures related to land use and economic development were very general. To evaluate the extent to which each alternative may support land use and community livability goals, as well as local economic development and policy goals, the following measures were used:

- Extent to which the alternative supports regional long-range planning and growth management (based on PSRC's VISION 2040 and Regional Economic Strategy)
- Extent to which the alternative supports current local comprehensive plans, land use, and zoning

- Support of local jurisdictions for transit-oriented growth in station areas (as described in adopted policies and plans)

While the analysis attempted to identify differences among the alternatives, clear conclusions could not be drawn from the results. This occurred both as a result of the level of development of the alternatives and the general measures used in the analysis. Table 3-16 summarizes the results of the analysis based on the three general criteria.

Table 3-16. Summary of Land Use and Economic Development Measures by Alternative

Alternative	VISION 2040 Support	Consistency with Comprehensive Plans, Land Use, and Zoning	Transit-Oriented Development Support at Stations (supported stations/total stations)
TSM/Baseline	Moderate	Moderate	3/5
L1: I-5 Light Rail	High (strong)	Moderate	2/4
L2: SR 99 Light Rail	High (strong)	High	4/5
B1: I-5 BRT	Moderate	Moderate	2/4
B2: Multi-Corridor BRT	Moderate	Moderate, but low along 15th Avenue NE	9/17

All alternatives connect two PSRC-designated Regional Growth Centers—Lynnwood and Northgate. The light rail alternatives, and particularly the L1: I-5 Light Rail Alternative, are the most supportive of VISION 2040 by connecting two Regional Growth Centers, providing the fastest transit service, and carrying the most people.

The other Level 1 land use and economic development measures were focused on the 0.5-mile area around potential stations. Although this is a reasonable approach regarding effects directly related to station area development, it can be misleading when comparing alternatives with varying modes, alignments, and several stations. For example, the light rail alternatives along SR 99 and I-5 include four or five stations, while the B2: Multi-Corridor BRT Alternative includes 17 stations. The L2: SR 99 Light Rail Alternative appears to have the highest consistency with existing land use and zoning plans and policies. However, the measures used during Level 1 were at a fairly high level and more detailed analysis will occur during the Level 2 evaluation. All jurisdictions have plans and policies supporting some degree of transit-oriented development near proposed station areas. Level 2 evaluation will include measures to determine the level of this support and methodology to compare this support across alternatives.

3.6.4 Environmental Performance

The information available at Level 1 allows general evaluation of typical right-of-way and vicinity impacts for a given alternative, but it does not yet take into account the potential for design treatments to avoid or minimize impacts. It also may not reflect the need for related facilities, such as widened intersections or lanes due to traffic impacts, or related facilities including retaining walls, noise walls, drainage, or stormwater treatment facilities. For the

analysis, three general criteria were used: right-of-way effects, effects on communities and neighborhoods, and effects on sensitive resources. The summary results are presented in Table 3-17 and discussed in the following sections.

Table 3-17. Summary of Environmental Performance

Alternative	Right-of-Way Effects	Community and Neighborhood Effects	Sensitive Resource Effects
TSM/Baseline	Low	Low	Low
L1: I-5 Light Rail	Low to Moderate	Low to Moderate	Moderate
L2: SR 99 Light Rail	High	Moderate to High	Low to Moderate
B1: I-5 BRT	Low	Low to Moderate	Low to Moderate
B2: Multi-Corridor BRT	Low	Low	Low

RIGHT-OF-WAY EFFECTS

The alternatives with the highest total right-of-way needs (new as well as existing public rights-of-way) were the light rail alternatives, with L2: SR 99 Light Rail followed by L1: I-5 Light Rail. The existing SR 99 right-of-way is about 80 to 100 feet wide and fully developed, while the I-5 right-of-way varies to over 200 feet in places and is not fully developed. Thus, the I-5 right-of-way includes areas outside the edge of the freeway pavement/shoulders or in a median, where light rail could potentially be accommodated. Light rail would typically require about 30 feet of right-of-way, and the Level 1 alignment assumed for I-5 light rail is largely within WSDOT's right-of-way. Some locations along I-5 require additional right-of-way, but for most of the I-5 alignment, existing right-of-way could be used with WSDOT's agreement. Based on the Level 1 concept layout, which is mostly elevated and mostly within WSDOT's right-of-way, an I-5 light rail concept could affect up to an estimated 80 properties, and about half of these could be full acquisitions. Most of the impacts would be at station areas and along the King County portion of I-5, where the right-of-way is most limited.

By contrast, the SR 99 corridor right-of-way is already largely occupied by the roadway, sidewalk, and related improvements, including sections recently widened to accommodate additional lanes and BRT. Therefore, the L2: SR 99 Light Rail Alternative is likely to require more new rights-of-way than the L1: I-5 Light Rail Alternative. Based on the Level 1 concept layout, SR 99 light rail could affect up to an estimated 200 properties, and about half of these could be full acquisitions. The areas with the highest potential for acquisitions were the residential and commercial properties along NE 110th Street, the southern parts of SR 99, near major intersections and stations, and along SR 104.

The two BRT alternatives would use some existing facilities such as the I-5 HOV lanes, but also would require other physical improvements, including stations, modified freeway interchanges, and other direct access improvements. These improvements would have low right-of-way

requirements, most of which are due to sections of freeway that would need to be widened near each of the three new direct access facilities.

The TSM/Baseline Alternative focuses primarily on service-oriented improvements with few other capital facilities and would have the lowest right-of-way needs.

EFFECTS ON COMMUNITIES AND NEIGHBORHOODS

To identify potential adverse changes to communities and neighborhoods, the proximity and nature of project improvements to residential neighborhoods was assessed. In addition, applicable factors were examined such as the level of right-of-way acquisitions; the potential for noise, visual, or traffic impacts; intrusion into residential neighborhoods; restricted access; and major changes in neighborhood setting or community facilities.

The TSM/Baseline Alternative has a low potential to affect communities and neighborhoods because the alternative would involve mostly operational and service-related improvements, with few elements that would alter the physical features or functions of neighborhoods.

The L1: I-5 Light Rail Alternative has a low-to-moderate potential for impacts to communities and neighborhoods, because it would be developed largely within the I-5 right-of-way, with limited intrusions into neighborhoods. Assuming a largely elevated alignment, mostly on the east side of I-5, visual and noise impacts could still occur. Station areas that are outside the WSDOT right-of-way have more potential for effects on neighborhoods due to increased traffic, structures, and related displacements.

The L2: SR 99 Light Rail Alternative has a moderate-to-high potential to affect communities and neighborhoods, due to its higher levels of acquisitions as well as the street modifications that would be required, particularly when the alignment is at-grade. Property acquisitions for both the elevated and at-grade sections would involve major changes to the SR 99 corridor; however, the properties immediately along SR 99 are largely commercial with relatively few residential properties. Higher numbers of residential areas occur along east-west connections, including the assumed alignment segments connecting to SR 99 along NE 110th Street and SR 104.

The B1: I-5 BRT Alternative would have low-to-moderate potential for impacts to communities and neighborhoods. However, to provide for the direct access facilities at Northgate, 145th Street, and 185th Street, the alternative would widen sections of I-5 to provide space in the median for the transit ramps to enter and exit HOV lanes, affecting about 1.25 miles of freeway at each access location.

The B2: Multi-Corridor BRT Alternative would have more limited impacts, focusing primarily on the area around I-5 and 130th Street. About 1 mile of freeway widening to provide direct access ramps could be accommodated with limited property acquisitions, but this would bring freeway facilities closer to residences, and existing vegetation or buffer areas would be reduced. This action would increase the potential for noise, visual, and other vicinity impacts from about 120th Street to about 135th Street along I-5.

EFFECTS ON SENSITIVE RESOURCES

This measure examines the potential for effects on sensitive resources, including parks, historic sites, streams/lakes/wetlands, or endangered species habitat. At this stage of project development, this remains a qualitative measure based on the location of the alignments and likely impacts of right-of-way acquisitions.

The TSM/Baseline Alternative has a low potential for effects on sensitive resources because it features few changes to the physical environment.

The L1: I-5 Light Rail Alternative would have a moderate potential for natural environmental impacts, primarily related to the presence of wetlands, streams, and vegetated spaces along the current WSDOT right-of-way where much of the alignment would be located. There is a lower potential for effects on other resources such as parks and historic properties, in part because the alignment is expected to remain largely within WSDOT right-of-way. Property acquisitions would be limited; although some buildings near the alignment are within the historic era (50 years or older), the potential for historic resource impacts appears to be low.

The L2: SR 99 Light Rail Alternative includes at-grade and elevated sections along SR 99 and would have low-to-moderate potential for effects on natural resources. This is because much of the corridor is within previously developed areas, with relatively few open streams, water bodies, and vegetated spaces in the immediate area of likely impact. As the alignment crosses east from SR 99 toward the Mountlake Terrace Freeway Station area, it would be in the vicinity of Lake Ballinger and share the same potential for natural resource impacts as the northern portion of L1: I-5 Light Rail Alternative. These potential impacts would include crossing McAleer Creek and other minor creeks, as well as other areas along the highway that are vegetated and may contain wetlands. The effects on park resources are expected to be limited; however, the alignment does involve a higher level of right-of-way acquisitions than other alternatives. Moreover, some buildings near the alignment are within the historic era (50 years or older), including some properties along SR 99 that appear on Snohomish County and King County historic site inventories.

The B1: I-5 BRT Alternative would have a low-to-moderate potential for natural environmental or sensitive built environment impacts, mostly due to widening and related construction effects potentially affecting several miles of the freeway, including near Northgate, at NE 145th Street, and at NE 185th Street (where a new park-and-ride would also be located). This alignment could affect water resources by creating new impervious surfaces, and widening could affect wetlands and streams adjacent to the freeway. However, because the physical improvements needed for I-5 BRT are not expected to be continuous along the alignment, the level of effects would still be less than for the L1: I-5 Light Rail Alternative.

The B2: Multi-Corridor BRT would also have a low potential for natural environmental or sensitive built environment impacts, although widening and related construction could affect water resources by increasing impervious surfaces near NE 130th Street, where widening would affect more than 1 mile of the freeway, including areas near two public parks.

3.6.5 Effects on Transportation System

Transportation system benefits and impacts include four qualitative measures that address general purpose traffic operations, transit operations, pedestrian and bicycle accessibility and mobility, and safety. Table 3-18 and the sections that follow summarize the performance on these measures.

Table 3-18. Summary of Transportation Effects

Alternative	Traffic Operations Effects	Transit Operations Benefits	Pedestrian and Bicycle Benefits	Transportation Safety Impacts
TSM/Baseline	Low	Low	Low	None to Low
L1: I-5 Light Rail	Low	High	Moderate	None to Low
L2: SR 99 Light Rail	High	High	Moderate to High	Low to Moderate
B1: I-5 BRT	Low	Low to Moderate	Low	None to Low
B2: Multi-Corridor BRT	Low	Low to Moderate	Low	None to Low

GENERAL PURPOSE TRAFFIC OPERATIONS

Both the TSM/Baseline Alternative and the L1: I-5 Light Rail Alternative would have minimal effects on traffic operations (except possibly during construction for the L1: I-5 Light Rail Alternative).

The L2: SR 99 Light Rail Alternative involves both elevated and at-grade sections. On SR 99, the elevated light rail would affect general traffic operations because of the column support locations. Columns could also displace the median turn lanes, which would shift traffic to other intersections. When light rail travels through an intersection at-grade, signal phasing is typically affected, and the traffic signal system would require pre-emption or favorable progression to facilitate efficient light rail operations. With proposed headways of 3 to 4 minutes in each direction, the required signal cycle would result in loss of green signal time for both cross streets and SR 99 left-turns, with possible deterioration in level of service (LOS). At-grade segments would block crossing movements between major intersections, thereby eliminating left turns to driveways and minor cross streets, as well as crossing movements for minor cross streets that would adversely affect property access. The resulting consolidation of these movements at major intersections would likely adversely affect operations. This alternative is also expected to have more substantial impacts on traffic during construction.

For the B1: I-5 BRT Alternative, general purpose traffic operations on the freeway would not be affected. Transit-only direct access ramps may even be a slight benefit for general purpose traffic because they would remove bus weaving movements from the left-side HOV lane to the right-side general purpose off-ramp; therefore, reducing conflicts near interchanges. Some effects may occur on freeway and ramp operations, as well as local arterials during construction of the direct access ramps and BRT station facilities at Northgate, NE 145th Street, and NE 185th Street.

The freeway operations, impacts, and benefits of the B2: Multi-Corridor BRT Alternative would be the same as the B1: I-5 BRT Alternative. On the arterials there could be additional intersections with traffic signal priority for buses (which may affect overall operations for general traffic), but there would be little, if any, impact on LOS. As indicated in the property access discussion above, additional bus volumes in the BAT lanes under the BRT alternatives could have a slight impact on right-turning traffic. Some effects may occur on freeway and ramp operations, as well as local arterials during construction of the direct access ramps at Northgate and NE 130th Street.

TRANSIT OPERATIONS

The TSM/Baseline Alternative includes a relatively small increase in transit service in the corridor, as well as direct service to light rail at Northgate. However, this benefit would likely be marginalized over time as congestion in the HOV lanes continues to increase. The new Shoreline-to-Northgate express bus route would not use the I-5 HOV lanes due to the lack of direct access ramps and the limited distance it would travel on I-5; hence, its reliability would be worse than the I-5 route.

Both the L1: I-5 Light Rail and L2: SR 99 Light Rail Alternatives provide a high level of speed and reliability benefit, although the light rail in the I-5 corridor would have shorter travel times. With light rail in either the I-5 or SR 99 corridor, some modifications may be made to existing express bus service in the I-5 corridor. In addition, local bus service may be modified or enhanced to feed light rail stations. BRT operations on SR 99 (*Swift* and RapidRide) are not anticipated to be affected by light rail operations, although ridership on those lines could increase because they would provide feeder service to the new light rail stations.

For both the B1: I-5 BRT and B2: Multi-Corridor BRT Alternatives, transit service would be improved. Transit-only direct access ramps from I-5 would provide quick access for BRT and other buses to the transit stations. The 15th Avenue NE corridor would include stop consolidation to improve transit travel time.

PEDESTRIAN AND BICYCLE ACCESSIBILITY AND MOBILITY

The TSM/Baseline Alternative would have only minor benefits for pedestrian and bicycle mobility. Overall, pedestrian and bicycle accessibility and mobility would be improved with implementation of the light rail and BRT alternatives, particularly with improvements to the pedestrian and bicycling environment around stations. These improvements will be defined during the design phase consistent with Sound Transit policies. However, pedestrian crossings may be consolidated with the development of an at-grade light rail alignment, which would affect pedestrian and bicycle accessibility.

SAFETY

The safety assessment was based on the potential for increased conflicts among vehicles, pedestrians, and bicycles. There are no changes expected with regard to safety for the TSM/Baseline, B1: I-5 BRT, or B2: Multi-Corridor Alternatives. The L1: I-5 Light Rail Alternative

would result in fewer buses in the HOV lanes of I-5 and therefore fewer potential conflicts between buses and general purpose vehicles.

The L2: SR 99 Alternative includes significant sections of at-grade light rail. Because the median alignment on SR 99 provides more controlled access, particularly for mid-block locations, some types of vehicle collisions may be reduced, such as those involving left-turning vehicles. However, this option also could increase the potential for conflicts with pedestrians and vehicles with light rail vehicles at-grade. Along SR 104, side-running at-grade light rail would include gated crossings for safety at intersections with streets and driveways. Safety would be improved with an elevated light rail facility, which would reduce conflicts with both pedestrians and vehicles.

3.6.6 Cost and Constructability

Preliminary capital and O&M costs were estimated for the alternatives and major constructability issues were assessed.

CAPITAL COSTS

Capital costs were estimated based on the capital cost estimating methodology documented in the *Sound Transit 2 Planning Capital Cost Estimating Methodology* report (Sound Transit 2007b) and by methods and data from the *North Corridor Transit Project Level 1 Alternatives Capital and Operations Cost Estimating Methodology and Results* report *(*Sound Transit 2011d*)* and the *North Corridor Transit Project Unit Cost Library and Composite Section Costs Report (*Sound Transit 2011e*)*. Table 3-19 shows cost ranges for the Level 1 alternatives.

Table 3-19. Capital Cost Ranges for Level 1 Alternatives

Alternative	Low (mid-2010 $million)	High (mid-2010 $million)
TSM/Baseline	$100	$120
L1: I-5 Light Rail	$1,520	$1,740
L2: SR 99 Light Rail	$1,870	$2,150
B1: I-5 BRT	$580	$670
B2: Multi-Corridor BRT	$460	$530

OPERATION AND MAINTENANCE COSTS

Estimated additional annual O&M costs for the Level 1 alternatives, above and beyond No Build Alternative, are provided in Table 3-20. These estimates are for the year 2030 and are expressed in mid-2010 dollars. For purposes of the Level 1 evaluation all bus O&M cost savings attributable to the introduction of light rail were assumed to be re-invested in feeder bus service.

Table 3-20. 2030 Operation and Maintenance Cost Estimates

Alternative	Annual O&M Cost (mid-2010 $million)
TSM/Baseline	$14
L1: I-5 Light Rail	$21
L2: SR 99 Light Rail	$26
B1: I-5 BRT	$18
B2: Multi-Corridor BRT	$36

CONSTRUCTABILITY FACTORS

Construction effects for the TSM/Baseline Alternative would involve minor traffic impacts associated with the off-ramp widening near Northgate and potentially at intersections where signal improvements may require new signals.

The L1: I-5 Light Rail Alternative involves significant construction along the I-5 corridor and would require traffic modifications to temporarily narrow the highway lanes and provide space for construction of the guideway. Temporary traffic closures could also occur where the guideway crosses traffic lanes. This situation would occur at the highway interchanges and where the guideway crosses I-5 from the east side to the west side. Careful construction would be necessary to minimize environmental impacts. Specifically, Thornton Creek near the NE 145th Street interchange and the wetlands near the Lynnwood Transit Center would require construction techniques to protect the sensitive areas. Because of the proximity to residential properties, noise regulations may impose limits on construction noise.

The L2: SR 99 Light Rail Alternative involves significant construction along SR 99 and would require reconstruction of the roadway, intersections, and utilities. Maintaining traffic and property access during construction would be required. Maintaining traffic LOS during peak hours may require that construction is performed during non-peak traffic hours. Temporary traffic closures could also occur where the guideway crosses traffic lanes. This situation would occur where an elevated guideway crosses over SR 99 and where the guideway crosses I-5. Night-time construction would likely be required so that traffic closures do not occur during peak traffic hours.

The B1: I-5 BRT and B2: Multi-Corridor BRT Alternatives require construction along the I-5 corridor and would involve traffic modifications to temporarily narrow the highway lanes and provide space for construction. The B1: I-5 BRT Alternative involves more locations along I-5 and would have greater impacts than the B2: Multi-Corridor BRT Alternative.

3.6.7 Consistency with Sound Transit's Long-Range Vision

This measure addresses the extent to which alternatives support the long-range vision, goals, and objectives for transit service established by Sound Transit's Long-Range Plan. Table 3-21 presents the results of the three criteria used to judge consistency with Sound Transit's long-range vision. These include conformity with the definition of HCT contained in Washington State law, the miles of operation of the transit alternative in general purpose traffic, and consistency with Sound Transit's Long-Range Plan. Based on these criteria, only the light rail alternatives meet all three tests of plan consistency. While the B1: I-5 BRT Alternative meets the state's definition of HCT and operates exclusively on either HOV lanes or transit-only ramps, it does not conform to Sound Transit's long-range vision or the ST2 Plan approved by voters in 2008, both of which call for light rail. Neither the TSM/Baseline Alternative nor the Multi-Corridor BRT Alternative is consistent with Sound Transit's long-range vision based on these three criteria.

Table 3-21. Level 1 Evaluation Results—Consistency with Long-Range Plans

Alternative	Definition of High Capacity Transportation System	Miles of Operation in General Purpose Lanes	Consistent with Sound Transit's Regional Transit Long-Range Plan
TSM/Baseline	No	4.7	No
I-5 Light Rail	Yes	0	Yes
SR 99 Light Rail	Yes	0	Yes
I-5 BRT	Yes	0	No
Multi-Corridor BRT	No	7.7	No

3.7 ALTERNATIVES CARRIED FORWARD INTO LEVEL 2 EVALUATION

This section provides a comparative analysis of the evaluation of the Level 1 Alternatives and the basis for the recommendations to continue development of the selected alternatives as Level 2 Alternatives. For each alternative, the findings on the key differentiating criteria are discussed followed by recommendations for the further development of the alternative in the Level 2 evaluation.

In general, all Level 1 alternatives meet the project's overall Purpose and Need to some degree, based on the Level 1 alternatives definitions and the performance measures applied at this stage. However, the results indicate significant differences among the alternatives on many of the criteria. Primary distinguishing factors among the alternatives at this level of analysis include findings associated with performance measures related to the Purpose and Need criteria comprising transportation performance, consistency with Sound Transit's Long-Range Plan, environmental performance, and cost and constructability.

Community equity, land use, and economic development were not major differentiators among the Level 1 alternatives at this level of development and analysis. These factors are likely to become more important as the alternatives are developed in greater detail and specific information is known about station locations, configurations, and the fit of the alternatives into the surrounding urban environment.

Table 3-22 summarizes the results of the Level 1 evaluation and the sections that follow discuss the results by alternative and make recommendations regarding the development of the Level 2 alternatives.

3.7.1 TSM/Baseline Alternative

The TSM/Baseline Alternative represents the most that can be done to improve the existing regional transit system to meet the project's Purpose and Need without major new capital investments. As would be expected, this alternative is the least effective of the build alternatives in meeting the principal transportation needs when compared to the major capital investments of the other alternatives. On the positive side, it is the least costly and has the fewest likely potential effects on both the natural and constructed environments.

From a transportation standpoint, the following are the key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 13,400, just over a quarter of the riders carried by the best performing alternative.
- Year 2030 annual new system riders of 0.98 million and 0.83 million hours of total travel time savings, roughly one-sixth of the new riders and travel time savings of the best performing alternative.
- Capacity to carry 1,440 passengers per hour per direction, roughly one-eighth of what the best performing alternatives can carry.
- Lynnwood-to-Northgate peak-period travel times of 28 minutes are twice the travel time of the best performing alternative.
- Based on the predominant operation on non-exclusive highly congested arterials and freeways, the TSM/Baseline Alternative has a high likelihood of much lower reliability than the alternatives that operate entirely on exclusive guideways.

The TSM/Baseline Alternative was one of two Level 1 alternatives judged to be inconsistent with Sound Transit's Long-Range Plan as a result of the predominance of operation in mixed traffic. Because this alternative has the least infrastructure investment and construction, it has the fewest potential impacts on the natural and man-made environment. Finally, with a range of capital investment of $100 to $120 million (mid-2010 dollars), it is by far the least costly of the Level 1 alternatives.

Table 3-22. Level 1 Alternatives Evaluation Summary

KEY TO RANKING

LOWER PERFORMING — HIGHER PERFORMING

	TSM TSM/Baseline	L1 I-5 Light Rail	L2 SR 99 Light Rail	B1 I-5 BRT	B2 Multi-Corridor BRT
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access and Capacity Needs					
Project Daily Riders	13,400	50,600	46,200	20,800	25,100
Annual New Riders	0.98 million	5.9 million	5.2 million	2.2 million	2.6 million
User Benefit Estimate— Annual Hours of Travel Time Saved	0.83 million	5.9 million	4.9 million	1.9 million	2.3 million
Practical Capacity (Directional Passengers/Hour)	1,260	8,880	8,880	2,700	2,700
Peak Transit Travel Time: Lynnwood to Northgate	28 minutes	14 minutes	21 minutes	25 minutes	24 minutes
Operations on Non-Exclusive Right-of-Way	14 miles	0 miles	0 miles	8.3 miles	25.8 miles
Number of At-Grade Signalized Intersections Traversed	9	0	7	0	45
Purpose and Need: Equitable Community Impacts and Benefits					
Not considered for Level 1 screening.					
Purpose and Need: Supportive Land Use and Economic Development Effects					
Level 1 measures show only minor differences among alternatives.					
Purpose and Need: Preservation of a Healthy Environment					
New Transportation Right-of-Way Requirements	Low	Low	Moderate	Low	Low
Impacts on General Purpose Traffic Operations	No change	• No change to freeway • Arterial impacts at stations	LOS, left turn and property access impacts on SR 99	• No change to freeway • Arterial impacts at stations	• No change to freeway • Arterial impacts at stations
Purpose and Need: Cost and Constructability					
Capital Cost *(Millions of Mid-2010 Dollars)*	$100 to $120	$1,520 to $1,740	$1,870 to $2,150	$580 to $670	$460 to $530
2030 Annual O&M Cost *(Millions of Mid-2010 Dollars)*	$14	$21	$26	$18	$36 million
Purpose and Need: Consistency with Sound Transit Long-Range Vision					
Operations in General Purpose Traffic Lanes	4.7 miles	0 miles	0 miles	0 miles	7.7 miles
Consistency with Definition of HCT in Long-Range Plan	No	Yes	Yes	Yes	No
LEVEL 2 EVALUATION RECOMMENDATION					
= Advance = Drop	→	→	→	⊗	→

In conclusion, it is recommended that the TSM/Baseline Alternative be modified and then carried forward into the Level 2 evaluation with changes to improve its performance in light of the findings from evaluating the two BRT alternatives. Based on the Level 1 development and evaluation of the two BRT alternatives, it is clear that a number of the lower-cost capital facility improvements and service additions are appropriate for inclusion in the TSM/Baseline Alternative during Level 2. These improvements are described in detail in Chapter 4, section 4.2. While this may result in some cost increase for the TSM/Baseline Alternative, it should improve its performance.

3.7.2 L1: I-5 Light Rail Alternative

The L1: I-5 Light Rail Alternative is essentially unchanged from the concept developed as the representative light rail alignment for the ST2 system planning work. In general, this Level 1 Alternative is the best performing as judged on transportation performance criteria, is the second most costly of the alternatives, and has the second highest potential for effects on the surrounding environment.

From a transportation standpoint, the following are key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 50,600, nearly four times the riders carried by the TSM/Baseline Alternative and over 4,000 daily riders more than the next best performing L2: SR 99 Light Rail Alternative.
- Year 2030 annual system new riders of 5.9 million and 5.9 million total hours of travel time savings, roughly six times the new riders and travel time savings of the TSM/Baseline Alternative and 10 to 20 percent better than the next best performing L2: SR 99 Light Rail Alternative.
- Capacity to carry 8,880 passengers per hour per direction, roughly 8 times the capacity of the TSM/Baseline Alternative and equal to the L2: SR 99 Light Rail Alternative.
- Lynnwood-to-Northgate peak-period travel times of 14 minutes are the shortest of all the alternatives. The next best performing alternative is 50 percent longer.
- Based on exclusive operation on a fully grade-separated guideway, the L1: I-5 Light Rail Alternative is the most reliable of all the alternatives studied in Level 1.

The L1: I-5 Light Rail Alternative is consistent with Sound Transit's Long-Range Plan as a result of full operation on exclusive, grade-separated guideway. Because this alternative involves major infrastructure investment and construction along its entire length, it has the second greatest potential for impacts on the natural and constructed environment. Only the L2: SR 99 Light Rail Alternative, which would require substantially greater amounts of new transportation right-of-way, has greater possible impacts. Finally, with a capital cost range of $1,520 to $1,740 million (mid-2010 dollars), it is the second most costly of the alternatives considered in Level 1.

In conclusion, it is recommended that the L1: I-5 Light Rail Alternative should be carried forward into the Level 2 evaluation. Conceptual design work is needed to refine the alignment plan and profile as well as locate and configure stations and supporting access infrastructure. Many sub-alternatives are possible in terms of the rail line location to the east, west, or within the median of the I-5 roadways; the rail guideway profile with a mix of at-grade, aerial, and underpass sections; and station locations and configurations. In addition, work needs to be undertaken with WSDOT to develop more detail on the integration of the light rail infrastructure into I-5 as well as surrounding communities. This additional work is needed to more fully analyze the potential cost and impacts of the L1: I-5 Light Rail Alternative and develop a better understanding of the relative performance of this alternative as it relates to land use and economic development around the potential station locations.

3.7.3 L2: SR 99 Light Rail Alternative

The L2: SR 99 Light Rail Alternative consists of a hybrid of two early concepts, combining both at-grade and elevated alignments along portions of SR 99 through the cities of Seattle and Shoreline. In addition, it includes sub-alternatives involving alternative alignments to connect to Northgate at the south and the Lynnwood Transit Center at the north. In general, this alternative is the second best performing of the Level 1 alternatives as judged on transportation performance criteria, and it is the most costly of the alternatives. Further, it has the highest potential effects on the surrounding environment because of the relatively large amounts of new transportation right-of-way needed compared to the other alternatives.

While the analysis completed to date is not definitive, it appears that the L2: SR 99 Light Rail Alternative may have the most proportionate beneficial land use and economic development effects around the proposed stations of all the alternatives studied in Level 1. A definitive conclusion will require more detailed analysis during the Level 2 evaluation.

From a transportation standpoint, the following are key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 46,200, the second highest of the alternatives studied and roughly 10 percent fewer than the best performing L1: I-5 Light Rail Alternative.
- Year 2030 annual new system riders of 5.2 million and 4.9 million total hours of travel time savings, which is the second best performing of the alternatives and roughly 10 to 15 percent lower than the best performing L1: I-5 Light Rail Alternative.
- Capacity to carry 8,880 passengers per hour per direction, roughly 8 times the capacity of the TSM/Baseline Alternative and equal to the L1: I-5 Light Rail Alternative.
- Lynnwood-to-Northgate morning peak-period travel times of 21 minutes are 7 minutes longer than the L1: I-5 Light Rail Alternative but faster than any of the other build alternatives.

- Based on fully exclusive guideway operation with limited at-grade crossings, the L2: SR 99 Light Rail Alternative is the second most reliable of all the alternatives. Only the fully grade-separated exclusive guideway of the L1: I-5 Alternative is more reliable.

The L2: SR 99 Light Rail Alternative is consistent with Sound Transit's Long-Range Plan as a result of full operation on exclusive guideway. Because this alternative involves the longest rail alignment (roughly 2 miles longer with one additional station compared to the L1: I-5 Light Rail Alternative) and the largest amount of new transportation right-of-way, it has the greatest potential for impacts on the natural and constructed environment of all the Level 1 alternatives. Finally, with a range of $1,870 to $2,150 million (mid-2010 dollars) it is the most costly of the Level 1 alternatives considered, roughly $200 to $300 million (mid-2010 dollars) more than the next most costly L1: I-5 Light Rail Alternative.

During concept screening and the Level 1 evaluation, a number of sub-alternatives were studied for the connection from Northgate Transit Center to SR 99, the SR 99 portion, and the connection back to the Lynnwood Transit Center. In the case of the connection from Northgate to SR 99, it is recommended that the tunnel sub-alternatives, both to 130th Street and along Roosevelt Way, be dropped from further study. This decision is based on the conclusion that at least two other possible alignments that do not require tunnels appear to perform equally or better. Along SR 99 itself, continuous use of significant sections of the parallel former Interurban right-of-way is also recommended to be dropped, as discussed in more detail in Section 3.4.3. This decision is based on the serious and probably unresolvable conflicts between a light rail alignment and the existing utility, trail, and private property access uses of the right-of-way. The power distribution line conflicts, in particular, do not appear solvable to the satisfaction of the affected utilities and could result in the need to acquire substantial new right-of-way to address their maintenance, expansion, and security concerns. Because other alignments along SR 99 appear to perform equal or better, use of the former Interurban right-of-way for light rail development is probably limited to short segments or crossings only, where the conflicts could be more easily addressed. Finally, only two options appear workable for the connection back to the Lynnwood Transit Center. These are the SR 104/I-5 and the SR 99/208th Street SW alignments.

In conclusion, it is recommended that the L2: SR 99 Light Rail Alternative should be carried forward into the Level 2 evaluation. Conceptual design work is needed to refine the alignment plan and profile as well as locate and configure stations and supporting access infrastructure. Work also needs to be completed to develop a better understanding of several sub-alternatives, and refine the integration of the alignment and stations into SR 99 and the surrounding communities. Finally, the Level 1 evaluation did not fully address the impacts of traffic and transit operations on light rail trains operating at-grade at 4-minute headways, as well as the implications of other operating scenarios. This additional work is needed to more fully analyze the potential cost and impacts of the L2: SR 99 Light Rail Alternative and develop a better understanding of the relative performance of this alternative as it relates to land use and economic development around the potential stations.

3.7.4 B1: I-5 BRT Alternative

The B1: I-5 BRT Alternative consists of a BRT line connecting the Lynnwood Transit Center to the Link light rail terminus station at the Northgate Transit Center. This alternative includes the development of new intermediate stations at NE 185th and 145th Streets and associated bus-only direct access ramps to and from the I-5 HOV lanes, as well as service levels designed to closely replicate the L1: I-5 Light Rail Alternative. The B1: I-5 BRT Alternative does not include any other changes to the configuration or operation of the I-5 HOV lanes between Lynnwood and Northgate.

In general, this alternative has slightly lower overall transportation performance compared to the B2: Multi-Corridor BRT Alternative, performing better than the latter only on the reliability criteria. However, it is the most costly Level 1 bus alternative and has the potential for higher impacts on the surrounding environment compared to the B2: Multi-Corridor BRT Alternative. The B1: I-5 BRT Alternative falls well short, however, of the performance of the light rail alternatives while having significantly fewer potential impacts and substantially lower capital costs than the light rail alternatives.

From a transportation standpoint, the following are key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 20,800, the second highest of the bus alternatives studied but nearly 20 percent less than the B2: Multi-Corridor BRT Alternative, and only 40 percent of the ridership on the best performing L1: I-5 Light Rail Alternative.
- Year 2030 annual new system riders of 2.2 million and 1.9 million total hours of travel time savings, which is the second best performing of the bus alternatives and roughly 30 to 40 percent of the best performing L1: I-5 Light Rail Alternative.
- Capacity to carry 2,700 passengers per hour per direction, which is highest of the bus alternatives but less than one third of the capacity of the light rail alternatives.
- Lynnwood-to-Northgate morning peak-period travel times of 25 minutes are 11 minutes longer than the L1: I-5 Light Rail Alternative and only 3 minutes faster than the TSM Alternative.
- Based on the extensive use of the HOV and transit-only direct access ramps and full operation in the I-5 HOV lanes, the B1: I-5 BRT Alternative is the most reliable of the Level 1 bus alternatives. However, given peak-period congestion levels in the I-5 HOV lanes, the B1: I-5 BRT Alternative would be significantly less reliable than the light rail alternatives.

The B1: I-5 BRT Alternative is consistent with the definition of HCT as a result of full operation on facilities not shared with general purpose traffic, but does not conform with the voter-approved ST2 Plan, which calls for light rail. Because this alternative involves more construction of new roadway and structures compared to other bus or BRT alternatives, it would have the greatest potential for impacts on the natural and constructed environment of the Level 1 bus

alternatives; however, these impacts would be substantially less than those of any of the light rail alternatives. Finally, with a capital cost range of $580 to $670 million (mid-2010 dollars), it is the most costly Level 1 bus alternative considered, although significantly lower in cost than the light rail alternatives.

Based on the findings from evaluating the two Level 1 BRT alternatives, it is recommended that the B1: I-5 BRT Alternative be dropped and only a modified version of the B2: Multi-Corridor BRT Alternative be carried forward. The primary reason for this recommendation is that the B2: Multi-Corridor BRT Alternative performs better from a transportation standpoint and has substantially lower costs.

3.7.5 B2: Multi-Corridor BRT Alternative

The B2: Multi-Corridor BRT Alternative consists of three BRT lines serving the project corridor between Lynnwood and the Link light rail terminus at Northgate. This alternative includes three alignments: 1) an I-5 BRT line that connects the Lynnwood Transit Center to the Northgate Transit Center with an intermediate stop at the Mountlake Terrace Freeway Station; 2) a line serving north Seattle and Shoreline in the SR 99 corridor that connects to I-5 at NE 130th Street; and 3) a line serving the 15th Avenue NE corridor from Mountlake Terrace through Shoreline and north Seattle to an I-5 connection at NE 130th Street. This alternative takes greatest advantage of the BRT infrastructure that already exists in both the SR 99 and I-5 corridors and adds transit-only I-5 HOV lane direct access ramps at NE 130th Street and Northgate to and from the south only.

In general, this alternative has the best overall transportation performance of the bus alternatives. It is less costly to implement than the B1: I-5 BRT Alternative and has fewer potential impacts as a result of less roadway additions. However, the B2: Multi-Corridor BRT Alternative falls well short of the performance of the light rail alternatives, while having significantly fewer potential impacts and substantially lower capital costs than the light rail alternatives.

From a transportation standpoint, the following are key findings compared to the No Build Alternative:

- Year 2030 average weekday riders projected to be 25,100, the highest of the bus alternatives studied but roughly 50 percent of the ridership on the best performing L1: I-5 Light Rail Alternative.
- Year 2030 annual new system riders of 2.6 million and 2.3 million total hours of travel time savings, which is the best performing of the bus alternatives and roughly 40 to 45 percent of the best performing L1: I-5 Light Rail Alternative.
- Capacity to carry 2,700 passengers per hour per direction, the highest of the bus alternatives but less than one third of the capacity of the light rail alternatives.
- Lynnwood-to-Northgate morning peak-period travel times of 24 minutes are 10 minutes longer than the L1: I-5 Light Rail Alternative but faster than any of the other bus alternatives.

- Because the B2: Multi-Corridor BRT Alternative includes a line on 15th Avenue NE that operates totally in mixed traffic until it reaches I-5 at NE 130th Street, as well as a line on SR 99 that operates in mixed traffic between SR 99 and I-5, it is not as reliable as the B1: I-5 BRT Alternative and significantly less reliable than the light rail alternatives.

The B2: Multi-Corridor BRT Alternative is not consistent with Sound Transit's Long-Range Plan as a result of the significant segments of mixed traffic operations of the 15th Avenue NE and SR 99 BRT lines. Because this alternative has fewer additional roadway improvements than the B1: I-5 BRT Alternative, it would have comparatively reduced potential impacts on the natural and man-made environment. Finally, with a capital cost range of $460 to $530 million (mid-2010 dollars) it is less costly by more than $120 to $140 million (mid-2010 dollars) than the B1: I-5 BRT Alternative.

Based on the findings from evaluating the two Level 1 BRT alternatives, it is recommended that a single concept with the best performing elements of the B2: Multi-Corridor BRT Alternative should be carried forward into the Level 2 evaluation. The large investment in direct access ramps and new stations adjacent to I-5 at NE 145th and 185th Streets in the B1: I-5 BRT Alternative add very little ridership compared to the combination of a new BRT line running express on I-5 through these areas and SR 99 and 15th Avenue NE BRT lines making stops to serve the same areas. The I-5 BRT freeway stations and ramps are costly to construct and have potential impacts on both the natural and constructed environments.

As a result, an alternative that includes the I-5, SR 99, and 15th Avenue BRT routes and infrastructure of the B2: Multi-Corridor BRT Alternative is recommended for further development in Level 2.

3.7.6 Possible Future Changes to I-5 by WSDOT

A final consideration for the evaluation of Level 2 alternatives relates to possible future changes to I-5 that are contemplated by WSDOT. The region's long-range plan calls for eventual development of managed lanes along the portion of I-5 in the North Corridor Transit Project area. WSDOT is considering a number of options that could result in reconstructing and tolling portions of the freeway to include one or more managed lanes in each direction of I-5 between Northgate and Lynnwood.

At this time the design, construction costs, and right-of-way requirements are not known, including the transportation system and environmental impacts from these improvements. Also, the project is not a part of the analysis of alternatives to meet the Purpose and Need of the North Corridor Transit Project. However, if implemented and successfully managed, these improvements should reduce average peak-period travel times by as much as 5 minutes between Lynnwood and Northgate and provide better reliability for buses operating in this section of I-5.

The sensitivity test undertaken as part of the Level 1 forecasting work concluded that ridership effects on the I-5 BRT line would be minor. While increasing peak-period running speeds to 45 mph would increase overall ridership on I-5 compared to the baseline B1: I-5 BRT Alternative,

nearly all the benefits would accrue to Community Transit's express routes to downtown Seattle and the University District. This effect occurs because, unlike Community Transit's express routes, the BRT line must exit and re-enter the managed lanes numerous times to serve stations between Lynnwood and Northgate.

4 DETAILED DEFINITION OF LEVEL 2 ALTERNATIVES

Based on the conclusions of the Level 1 alternatives evaluation, two light rail alternatives and one BRT alternative, along with the TSM/Baseline and No Build Alternatives, were advanced to the next level of development and evaluation. The findings of the Level 1 evaluation also resulted in recommended refinements and modifications to all of the build alternatives. This chapter summarizes the detailed definitions of the No Build, TSM/Baseline, and three build alternatives carried forward for Level 2 evaluation. Additional information and more detailed alignment and station illustrations are provided in the *Level 2 Definition of Alternatives Technical Memorandum* (Sound Transit 2011f).

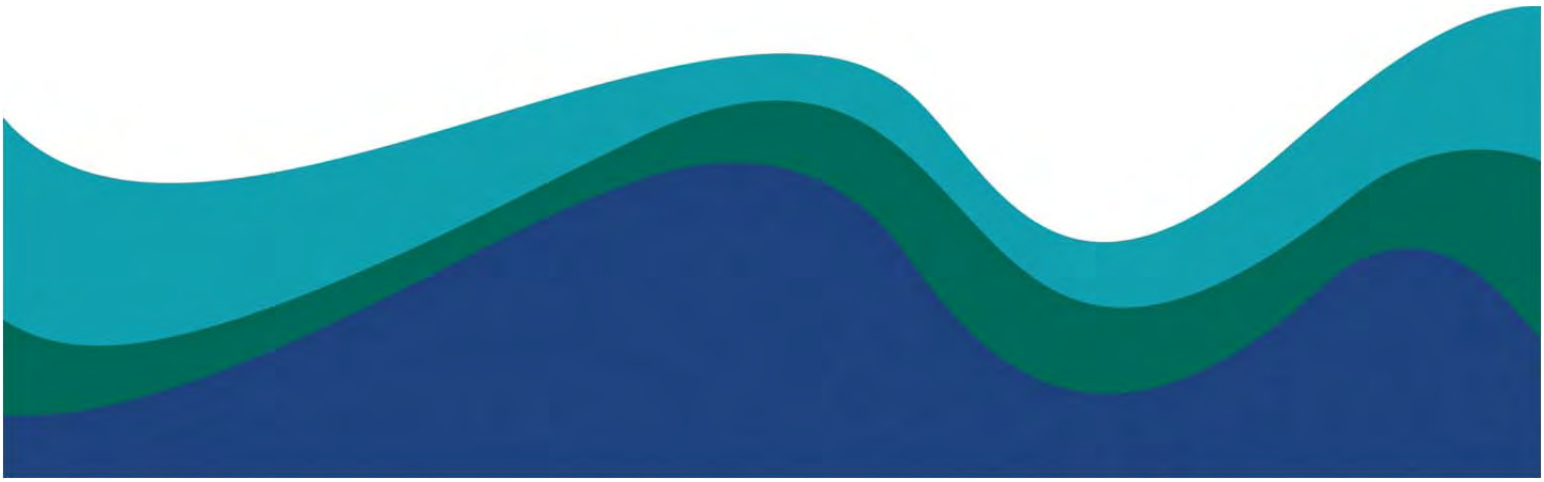
The assumptions and guiding principles for the development of the Level 2 alternatives remained the same as those described in Section 3.7.1 for the Level 1 alternatives.

4.1 NO BUILD ALTERNATIVE

The Level 2 No Build Alternative included only those improvements committed and funded for implementation by the transportation providers in the region. The Level 2 No Build Alternative was unchanged from that defined in Level 1.

4.1.1 Transportation Facilities

Only those physical improvements currently funded and committed as of fall 2010 are included in this alternative. Within the study area, these improvements include a number of minor lane additions and modifications to eliminate choke points along I-5, traffic management, and driver information improvements on I-5; and the completion of roadway, BRT, and intersection improvements to SR 99 in Shoreline. The most significant change from today in the study area included in the No Build Alternative is the assumption that light rail extends north to Northgate.



In addition, the balance of the 2008 voter-approved ST2 Plan, as shown in Figure 2-1, is assumed to be in place with light rail service running east to Overlake in Redmond and south to Redondo/Star Lake in Federal Way. By 2030 it is assumed that light rail service on the section between downtown Seattle and Northgate would operate at a combined 4-minute headway (the time between successive train or bus movements in a given direction) in each direction during peak periods and be served by two lines, one continuing east across Lake Washington and the other continuing south to Federal Way.

4.1.2 Bus Service Plan

Major changes in King County Metro bus service in the corridor will be made as a result of the extension of light rail to Northgate and the addition of the RapidRide E Line, a new BRT route serving SR 99 (Aurora Avenue) from Shoreline to downtown Seattle. No significant restructuring of Community Transit bus service between Snohomish County and the major destinations in King County was assumed.

The assumed changes to King County Metro routes at Northgate are based on routing developed in 2004 by King County Metro to respond to proposed light rail service reaching Northgate. Once light rail service extends to Northgate, the following King County Metro routes currently serving Northgate would be discontinued:

- Route 41 (Lake City/Northgate to Seattle): Replaced by Route 75 (Lake City to Northgate)
- Route 66 (Northgate to Seattle via Roosevelt/Eastlake)
- Route 68 (Northgate to the University District via 25th Avenue NE): Replaced by Routes 16/63

In addition to the changes related to Link light rail service to Northgate, the King County Metro RapidRide E Line will replace the existing Route 358 and run from the Aurora Village Transit Center at the county line along the length of SR 99 to downtown Seattle. Features of the E Line include enhanced stations, limited stops, BAT lanes, and transit signal priority—all of which will improve speed and reliability. The goal is for more frequent, fast, and reliable service than what is currently operated by King County Metro Route 358.

4.2 TSM/BASELINE ALTERNATIVE

The Level 2 TSM/Baseline Alternative is a modified version of the alternative evaluated during level 1 and described in Chapter 3. Based on the findings of the Level 1 evaluation of both the TSM/Baseline and the two BRT alternatives, a number of service changes and low-cost improvements appear promising and were added to the former. The primary elements of the Level 2 TSM/Baseline Alternative are three new express bus routes:

- A route via I-5 connecting the existing Lynnwood Transit Center with the Link light rail station at Northgate, with a stop at the existing Mountlake Terrace Transit Center freeway station.

- A route connecting the existing Edmonds Park-and-Ride with the Link light rail station at Northgate via SR 99, North 175th Street and I-5, serving a stop at 220th Street SW, an expanded Shoreline Park-and-Ride and Transit Center, a stop at North 175th Street/ Meridian Avenue, and the existing NE 145th Street freeway flyer stop on I-5 along the way. This route would serve as an express service complementing the existing *Swift* and RapidRide Line E services. While sharing stations, facilities, and the BAT lanes, the latter two BRT services stop much more frequently than the new express line.
- A route connecting the existing Mountlake Terrace Park-and-Ride and Transit Center with Northgate via 236th Street SW, 56th Avenue West, 19th Avenue NE, 15th Avenue NE, NE 175th Street, and I-5, with stops at Ballinger Way, NE 175th Street/15th Avenue NE, and the NE 145th Street freeway flyer stop.

4.2.1 Facility Design

In addition to the new express bus routes, the TSM/Baseline Alternative includes a number of new park-and-ride facilities, improvements, and expansions at existing stations and park and ride facilities, as well as traffic engineering, roadway, and signalization improvements at a modest cost to enhance the service additions. These are shown in Figure 4-1 and described in the following sections.

NORTHGATE STATION

The three additional routes serving the Northgate Transit Center and light rail station will require nine additional bus layover spaces at Northgate. In-service bus bay needs can be met by the existing facility.

TRANSIT SPEED AND RELIABILITY IN NORTHGATE AREA

Currently, buses providing service southbound on I-5 to Northgate must weave across several lanes on I-5 from the left-side HOV lane to the right-side exit ramp to eastbound Northgate Way. Buses then must turn right onto eastbound Northgate Way and then right again onto southbound 1st Avenue NE, often experiencing significant delays while making these movements. This alternative includes the addition of a transit-only lane extending from the beginning of the southbound off-ramp to the intersection of Northgate Way, and then eastbound under the I-5 mainline in an added transit-only lane to the intersection of Northgate Way/1st Avenue NE, and then southbound for a short distance along 1st Avenue NE. The transit-only lane (Figure 4-2) would provide travel time savings and improved reliability for southbound bus service to Northgate. The bypass would be separated from the existing lanes with a center curb to prevent encroachment by general purpose traffic. Similarly, a new northbound transit-only left-turn lane to supplement the existing left-turn lane at the intersection of 1st Avenue NE and the I-5 northbound on ramp would provide travel time savings and improved reliability for northbound bus service accessing I-5. In addition to these improvements, transit signal priority strategies would be implemented at the traffic signals the buses pass through between the interchange and the transit center.

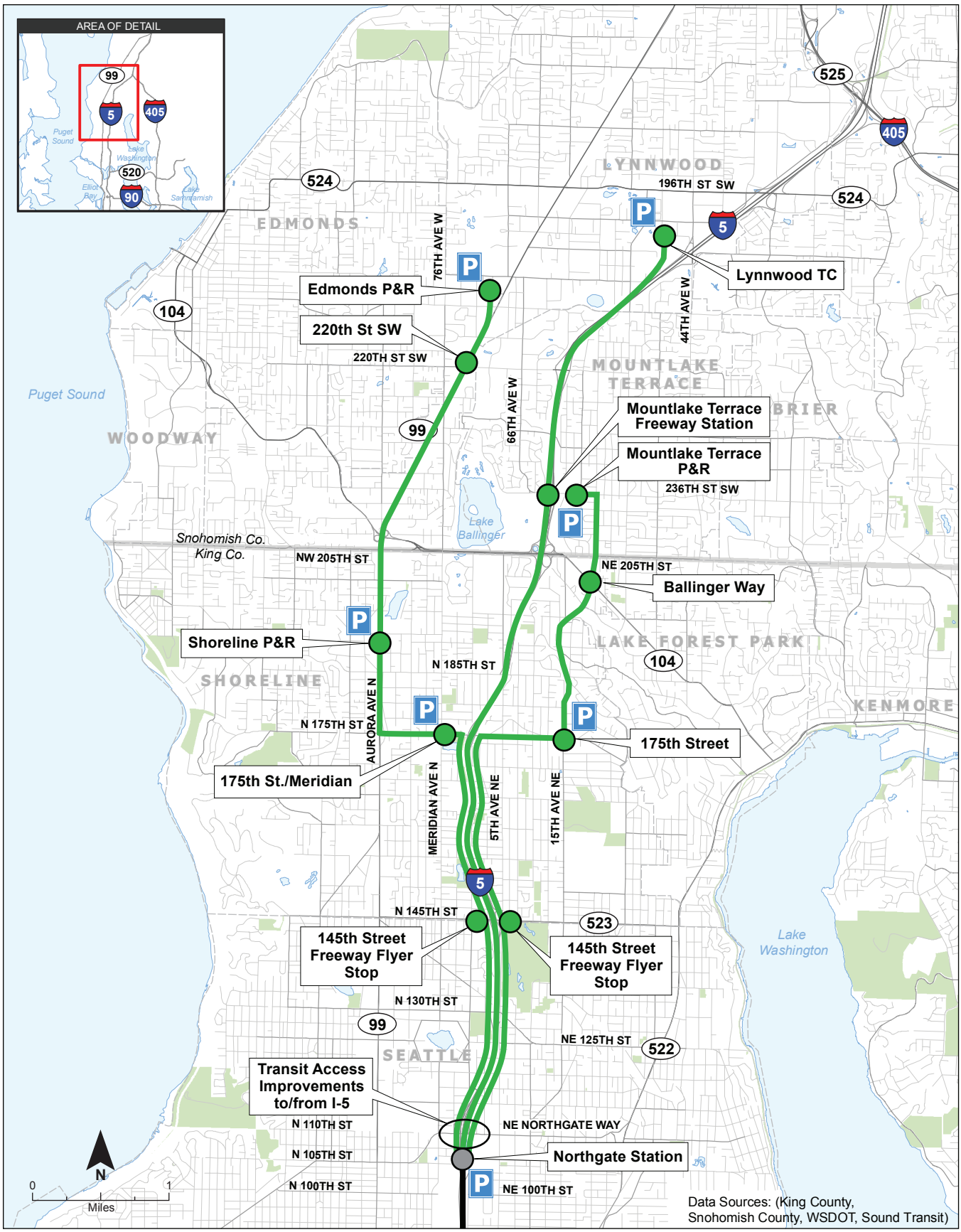


Figure 4-1. Level 2 TSM/Baseline Alternative

Figure 4-2. Northgate Area Transit Queue Bypass Improvement

SHORELINE PARK-AND-RIDE

The TSM/Baseline Alternative assumes that the transit terminus functionality of the Aurora Village Transit Center would be re-located to the Shoreline Park-and-Ride (currently with a parking capacity of 400 stalls), along with the existing 200-stall park-and-ride capacity of the Aurora Village Transit Center. An additional 150 stalls of new parking capacity would be provided, for a combined total of 750 park-and-ride stalls. The re-located transit center would consist of 16 bays for in-service and layover operations. These changes allow the new express BRT line to interface with both the *Swift* BRT line from the north and the RapidRide Line E service from the south without time-consuming deviation from SR 99. *Swift* BRT would be extended south to terminate at the Shoreline Park-and-Ride.

NORTH 175TH STREET/MERIDIAN AVENUE PARK-AND-RIDE

A new park-and-ride facility with 300 spaces would be constructed near the intersection of North 175th Street and Meridian Avenue. This would be served by the new express route from Edmonds Park-and-Ride to Northgate.

I-5/NE 145TH STREET PARK-AND-RIDE

The existing park-and-ride facility at I-5 and NE 145th Street would be expanded from 68 stalls to a total of 150 spaces. This would be served by two new express routes: Edmonds Park-and-Ride to Northgate and Mountlake Terrace to Northgate.

NE 175TH STREET/15TH AVENUE NE PARK-AND-RIDE

A new park-and-ride facility with 300 spaces would be constructed near the intersection of NE 175th Street and 15th Avenue NE. This would be served by the new Mountlake Terrace to Northgate express route.

EDMONDS PARK-AND-RIDE

The Edmonds Park-and-Ride to Northgate express route would terminate at the existing Edmonds Park-and-Ride. In-service and layover bus bay requirements for this route would be met with existing on-street space. An additional 100 spaces of parking capacity would be added to the park-and-ride facility for a total of 350 spaces.

MOUNTLAKE TERRACE PARK-AND-RIDE

The existing Mountlake Terrace Park-and-Ride facility would be served by the new Mountlake Terrace to Northgate express route. The existing 890-stall facility would provide in-service and layover bays for the new express route.

LYNNWOOD TRANSIT CENTER

The Lynnwood to Northgate express route would terminate at the Lynnwood Transit Center. This route would require seven additional layover spaces. In-service bus bay needs would be met by the existing facility. An additional 500 stalls of parking capacity would be added, for a total of approximately 1,900 park-and-ride stalls.

4.2.2 Service Plan

This alternative includes three new bus routes, as described earlier and shown in Figure 4-1, to connect the project area to the Link light rail station at Northgate. All three new routes would be subject to potential delays between the I-5 interchange and the Northgate Link Station, which can be substantial during morning and evening peak hours, as well as times of high shopping activity at the adjacent Northgate Mall regional shopping center complex. Priority treatments would help to mitigate these delays, but would not completely eliminate them. In addition, the new Edmonds to Northgate and Mountlake Terrace to Northgate routes would not be able to use the I-5 HOV lanes, because they would enter I-5 at 175th Street, stop at the existing 145th Street flyer stops, and exit at Northgate Way.

Express bus service on all three routes would be provided from 4:30 am to midnight (actual schedule would be timed for first inbound and last outbound trains at Northgate). Service frequencies were developed and refined to meet the projected ridership demand. Resulting headways were as follows:

- Lynnwood to Northgate route: 3.75 minutes during peak periods and every 15 minutes during off-peak periods
- Edmonds to Northgate route: 12 minutes during peak periods and every 15 minutes during off-peak periods
- Mountlake Terrace to Northgate route: 15 minutes during peak and off-peak periods

King County Metro Routes 301 and 303 would be replaced by the new Edmonds Park-and-Ride to Northgate Express route. Community Transit routes that now serve the Aurora Village Transit Center would be extended south on SR 99 to serve the new Shoreline Transit Center. Similarly, King County Metro routes that now serve the Aurora Transit Center would be truncated at the new Shoreline Transit Center.

4.3 L1: I-5 LIGHT RAIL ALTERNATIVE

The L1: I-5 Light Rail Alternative advanced to the Level 2 evaluation is similar to the L1: I-5 Light Rail Alternative assessed as part of the Level 1 evaluation. However, for Level 2 evaluation, the profile of this alignment was refined to take advantage of opportunities to place both the guideway and stations at ground level. In general, placing the rail line at the same level as I-5, where possible, based on available right-of-way, topography, and other conditions, has numerous advantages over placing the line on aerial structure. In addition to reducing costs, ground-level placement has the potential to minimize visual and noise impacts on adjacent land uses, and provides easier access for maintenance. The alignment refinement resulted in a combination of an elevated and at grade double-track rail line from Northgate to the Lynnwood Transit Center with intermediate stations at NE 145th Street, NE 185th Street, and the Mountlake Terrace Transit Center. Figure 4-3 provides an overview of the alternative, while Figures 4-4 through 4-7 provide more detail regarding alignment, profile, and station locations. Because of the topography along this section of I-5, much of the light rail ground level sections would be in retained cut-and-fill sections adjacent to the freeway. Much of the line can be located within the existing freeway right–of-way, but there are a number of locations where additional property would need to be acquired either for the guideway or station facilities and park-and-ride structures. These acquisitions may result in the displacement of some residences that are now located adjacent to I-5. The general scope of work includes:

- Capacity for new light rail fleet and O&M facility, as needed, to support the extension.
- Operation of up to four-car light rail trains between Northgate and Lynnwood in two directions, 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes.

- New light rail stations at NE 145th Street, NE 185th Street, Mountlake Terrace Transit Center (I-5 at SW 236th Street), and Lynnwood Transit Center. All stations would be elevated, with the exception of the NE 185th Street Station, which would be at-grade.
- Five hundred new structured park-and-ride stalls at each of the North 145th Street, North 185th Street, and Lynnwood Transit Center Link stations, supplementing approximately 2,300 existing stalls along the alignment.
- Restructured bus services consistent with 2007 bus/light rail service integration work done by Sound Transit, Community Transit, and King County Metro for ST2 to address bus route changes compatible with light rail extended into south Snohomish County.
- Additional in-service and/or layover bus bays at new stations as needed to accommodate restructured bus services.

4.3.1 Facility Design

The proposed L1: I-5 Light Rail Alternative would be approximately 8.5 miles in length. The line starts at the Link light rail station at Northgate on the east side of I-5, which is now in final design and scheduled to open for service in 2021, and ends at the existing Lynnwood Transit Center on the west side of I-5. Because of the difficulties, impacts, and costs of crossing the freeway, the approach to alignment development at this stage was to minimize the number of times that the alignment crosses I-5. For the sections through Seattle and Shoreline, little if any space is available in the I-5 median, so the only alignments that avoid major roadway reconstruction are along the east or west side of the freeway. In Snohomish County, the I-5 median is wide enough to become a possible location for the light rail infrastructure without needing to rebuild the freeway.

Opportunities for locating stations are additional significant considerations in determining the alignment. An important station siting factor is to provide access to existing transit facilities such as transit centers and park-and-ride facilities to leverage investments where riders can connect to the regional system. The selection of station sites must also consider impacts on the alignment. If the location of stations frequently alternates from the east to the west side of I-5, this would require more structures to cross I-5, with more potential for impacts to I-5 and adjacent properties.

The North 145th Street Station is best located on the east side of I-5, where an existing park-and-ride lot and other available right-of-way provide more land to site the station, guideway alignment, and a parking area, although some private properties would still be needed. The topography in the area is also better for siting the station, park-and-ride facility, and aerial guideway alignment. In addition, 5th Avenue NE provides an additional buffer separating the light rail alignment, the station, park-and-ride facility, and adjacent properties. By comparison, a station and guideway alignment on the west side would have a higher potential to affect existing water resources. In addition, the topography rises above I-5 making the station development more difficult without affecting a greater number of properties. Lakeside School, located west of I-5, and private residences on the north side of NE 145th Street could be affected with a station and park-and-ride facility. Additionally, Thornton Creek crosses I-5 at

NE 145th Street, and then runs parallel to I-5. A west side alignment would likely affect the creek and would also remove vegetated and forested areas that provide a buffer between I-5 and adjacent properties.

The NE 185th Street Station could be sited on either the east or west side of I-5, but the light rail guideway alignment would be more ideally located on the east side to serve the NE 145th Street and Mountlake Terrace stations that appear to be best located on the east side of the freeway. This configuration has resulted in a primary alignment with some station facilities to the west of I-5, but a light rail alignment and passenger platform to the east.

The Mountlake Terrace Station is best located either in the median of the freeway or the east side to take advantage of the existing transit infrastructure and minimize new transportation right-of-way requirements. A light rail guideway alignment and station located on the west side of I-5 would have greater right-of-way impacts and require long pedestrian bridges across I-5 to access the existing transit center and parking garage. Right-of-way on the west side of the freeway is more constrained than on the east side due to the existing SR 104 and 236th Street SW freeway ramps. Avoiding these ramps would require placing light rail on or adjacent to a golf course that has both public and private ownership, as well as potential wetlands. The west side of I-5 opposite the existing Mountlake Terrace Transit Center also has steeper forested slopes immediately adjacent to I-5 and 236th Street SW, with residential properties nearby.

For these reasons, a "primary" alignment was chosen for the purposes of the Level 2 evaluation that runs along the east side of I-5 from Northgate to Mountlake Terrace, crosses the I-5 northbound lanes north of Mountlake Terrace, then runs in the freeway median until finally crossing the southbound lanes to reach the Lynnwood Transit Center.

In developing the I-5 light rail alignment, ongoing coordination with WSDOT led to a determination that the light rail infrastructure should be located so as to not unduly constrain future modifications to the freeway. In partnership with WSDOT, it was determined that this need could be satisfied by preserving an 84-foot-wide envelope extending from the current freeway centerline to a future eastern edge of pavement along the northbound lanes of I-5 between interchanges. The conceptual alignment developed is based on preserving this 84-foot-wide envelope between interchanges and assumes an additional 40-foot envelope for light rail operation at freeway level (i.e., at-grade, in retained cut or retained fill), which is generous in comparison to typical width requirements for at-grade rail on level ground (e.g., 30 feet). The larger envelope assumed is primarily to account for additional width required for retained cut or fill. In most sections of the alignment, sufficient right-of-way exists to accommodate both the 84-foot freeway and 40-foot light rail envelopes. However, some sections would require partial acquisitions of multiple property parcels. It is possible that many of these could require full parcel acquisitions because they are either small parcels, or because access to them has been severed (which could occur if it is necessary to take part of a residential street next to the freeway). More details on potential right-of-way impacts will be evaluated in subsequent analyses. Figures 4-8, 4-9, and 4-10 show a typical cross-section of I-5 with light rail elevated and at-grade on the east side of the roadway, as well as in the median of the roadway, respectively.

The sections that follow describe the major components that form the light rail line along the I-5 alignment between Northgate Transit Center and Lynnwood Transit Center. Line segments and stations are included in these descriptions. Light rail vehicles and the O&M facility capacity to support the light rail line are not included in these descriptions and are the subject of a separate system-wide study that Sound Transit is now undertaking. As the design of the line is refined, requirements for passenger drop-off facilities, local bus transfers, and street and traffic signal improvements around the stations will be further investigated. Refinement of the pedestrian connectivity infrastructure will also need to be considered. For the purposes of developing conceptual cost estimates, it was also assumed there would be one track crossover in the vicinity of each station.

NORTHGATE TRANSIT CENTER TO NE 145TH STREET

The alignment begins at the north end of the planned Northgate Link station tail tracks in the Northgate Mall parking lot east of 1st Avenue NE. It continues north in a mix of elevated and at-grade profiles on the east side of I-5 to NE 145th Street, where it would arrive at an elevated light rail station at NE 145th Street. A center platform aerial station with a ground level plaza would be located above NE 145th Street, with station entrances on the south and north sides of NE 145th Street. The NE 145th Street Station would include the following:

- Park-and-ride garage of 500 parking spaces, representing a 430 space expansion over the existing small open lot
- Elevated pedestrian walkway between the parking garage and the light rail station
- Provisions for both on-street and possibly off-street bus bays and layover stalls to be determined

NE 145TH STREET TO NE 185TH STREET

The alignment for this segment begins north of the NE 145th Street Station. It would continue north in a predominantly at-grade profile on the east side of I-5 to the NE 185th Street Station, with short sections of elevated alignment over arterials crossing under I-5. An at-grade station would be located under a rebuilt NE 185th Street overpass. The NE 185th Street Station includes the following:

- Park-and-ride garage with 500 parking spaces located on the west side of I-5 across from the station
- Elevated pedestrian walkway across I-5 between the parking garage and the light rail station
- Two off-street in-service bus bays
- Two off-street layover bays

Figure 4-3. L1: Level 2 I-5 Light Rail Alternative

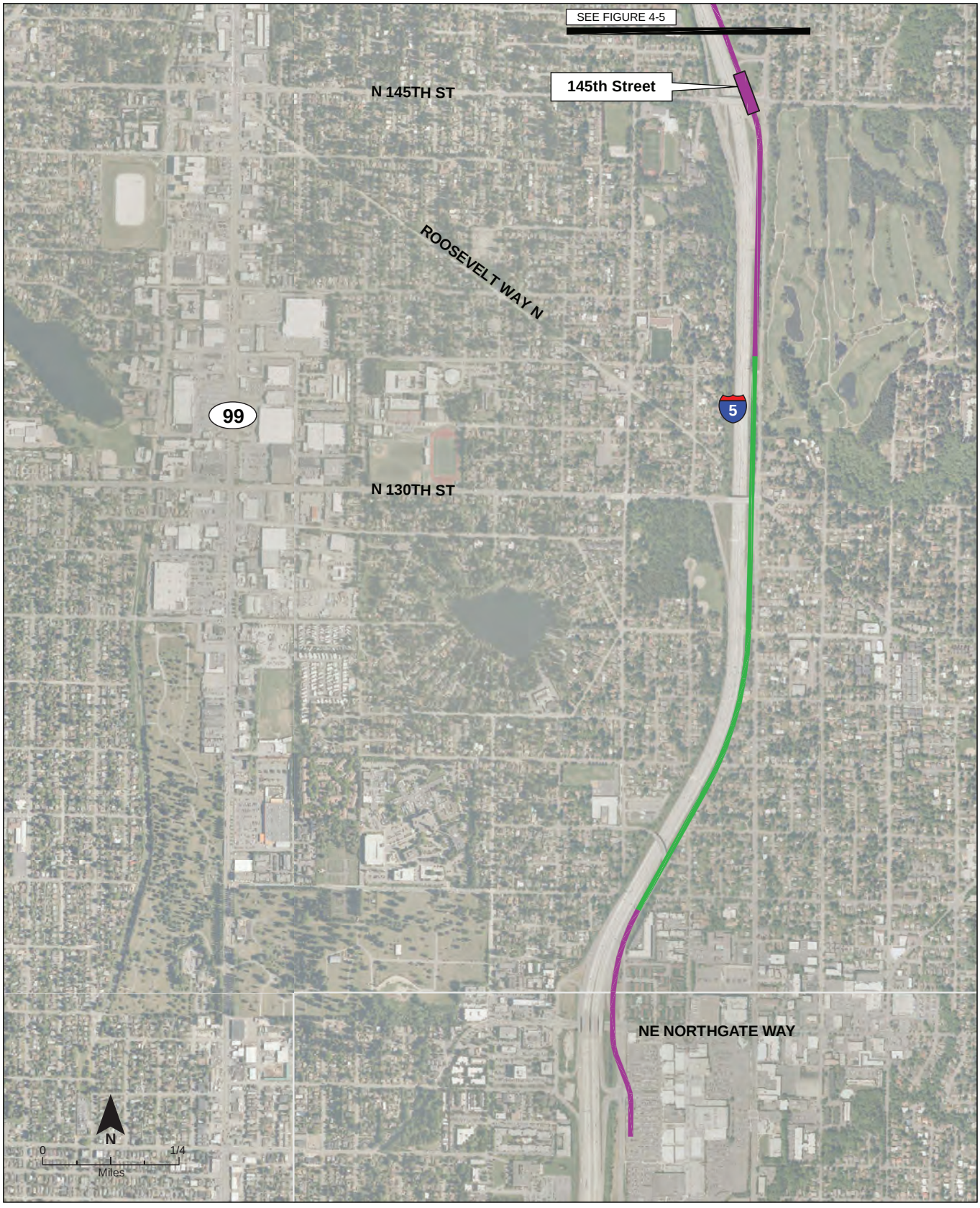


Figure 4-4. L1: Level 2 I-5 Light Rail Alternative Detail - 1 of 4

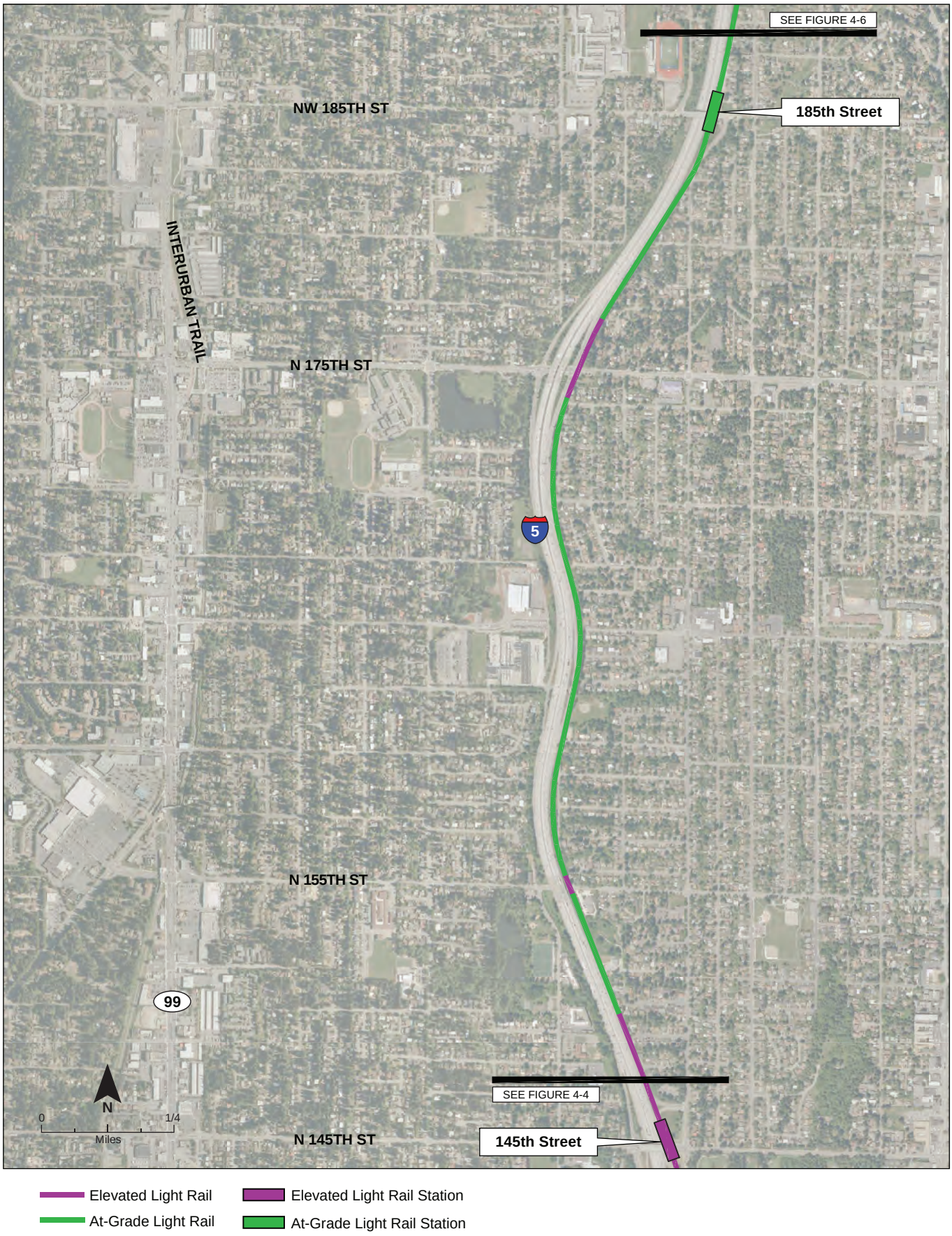


Figure 4-5. L1: Level 2 I-5 Light Rail Alternative Detail - 2 of 4

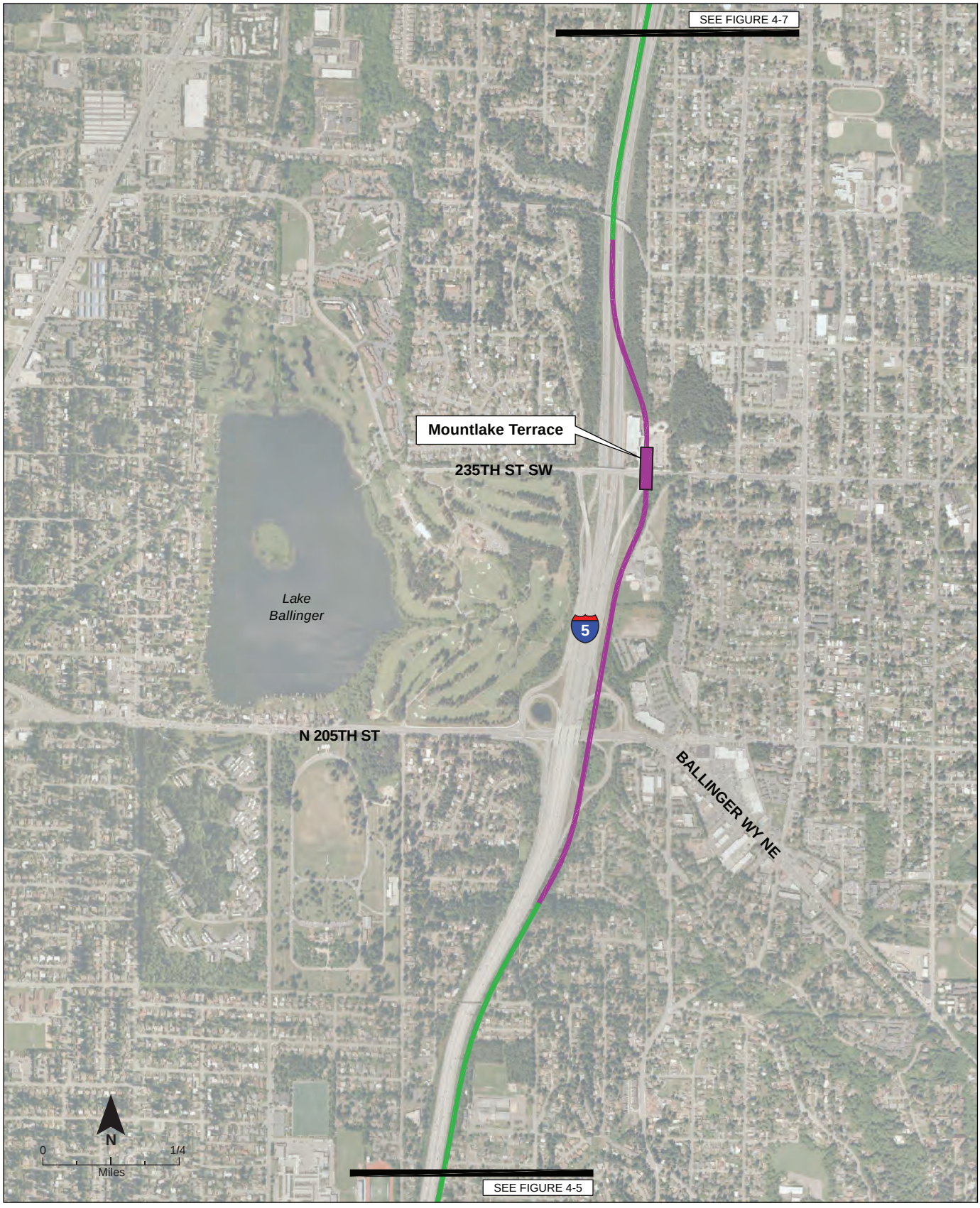


Figure 4-6. L1: Level 2 I-5 Light Rail Alternative Detail - 3 of 4

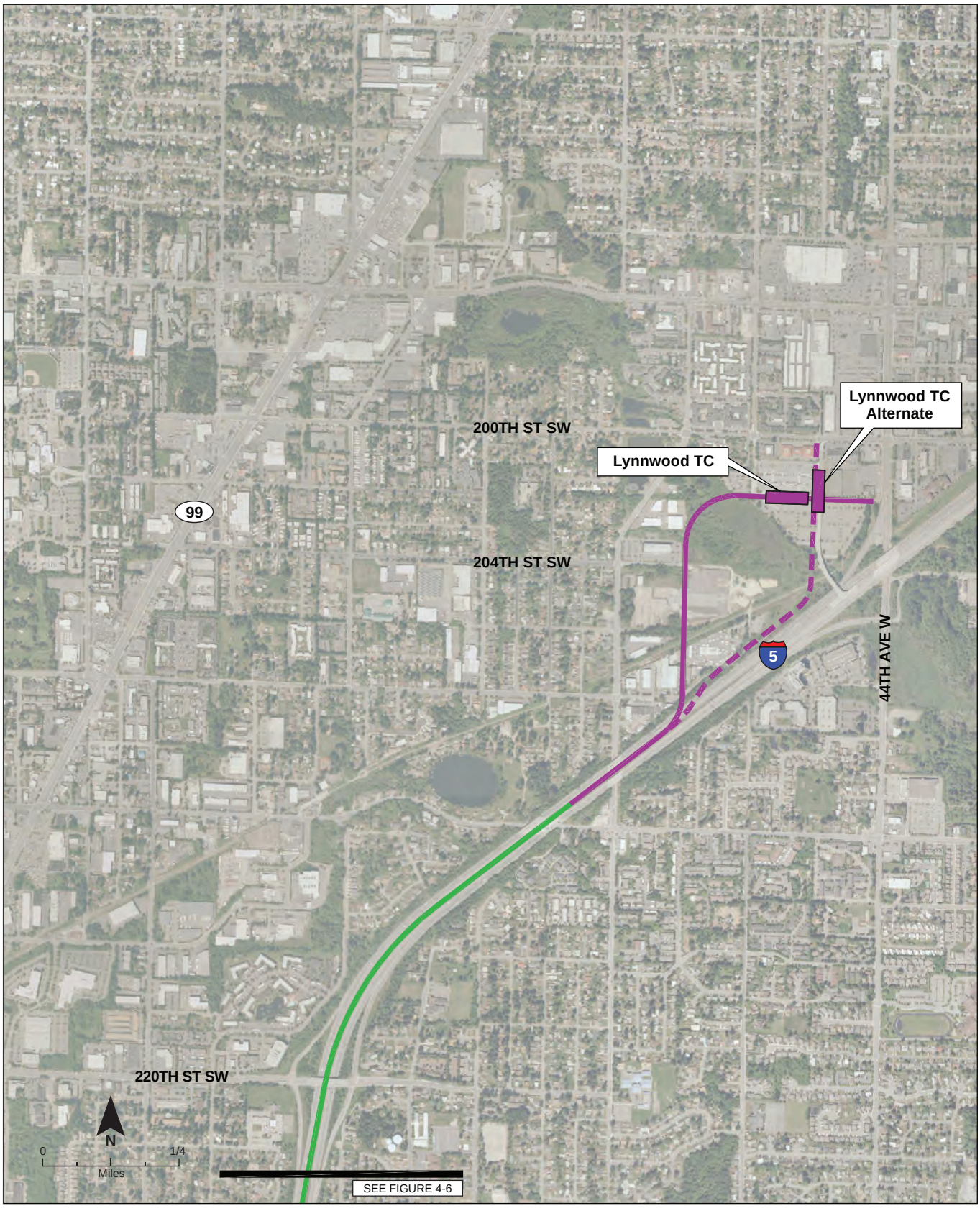


Figure 4-7. L1: Level 2 I-5 Light Rail Alternative Detail - 4 of 4

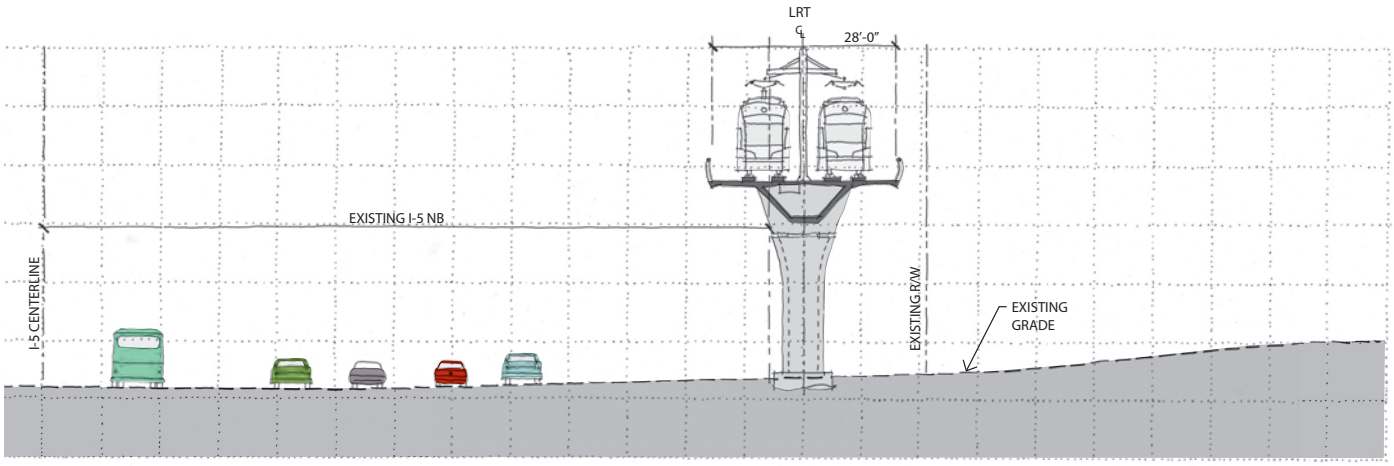


Figure 4-8. L1: I-5 Light Rail Alternative - Typical Cross-section of Elevated Rail on East Side of Roadway

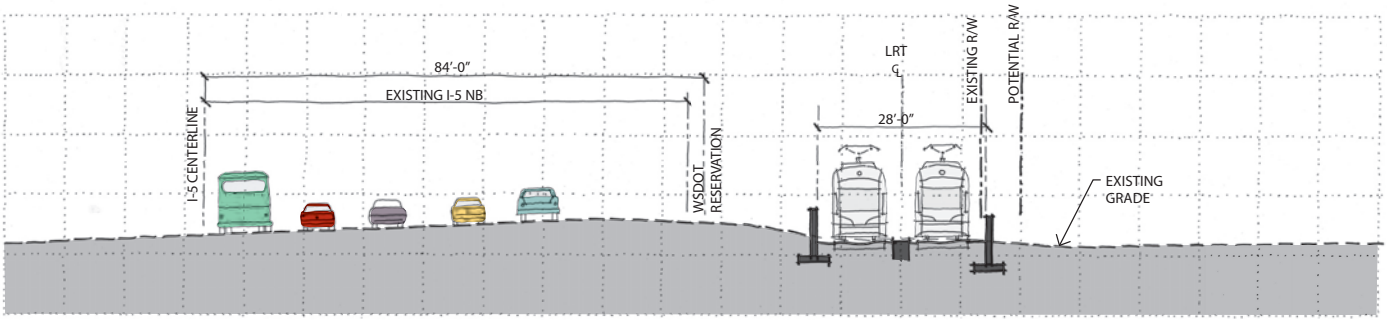


Figure 4-9. L1: I-5 Light Rail Alternative - Typical Cross-section of At-grade Rail on East Side of Roadway

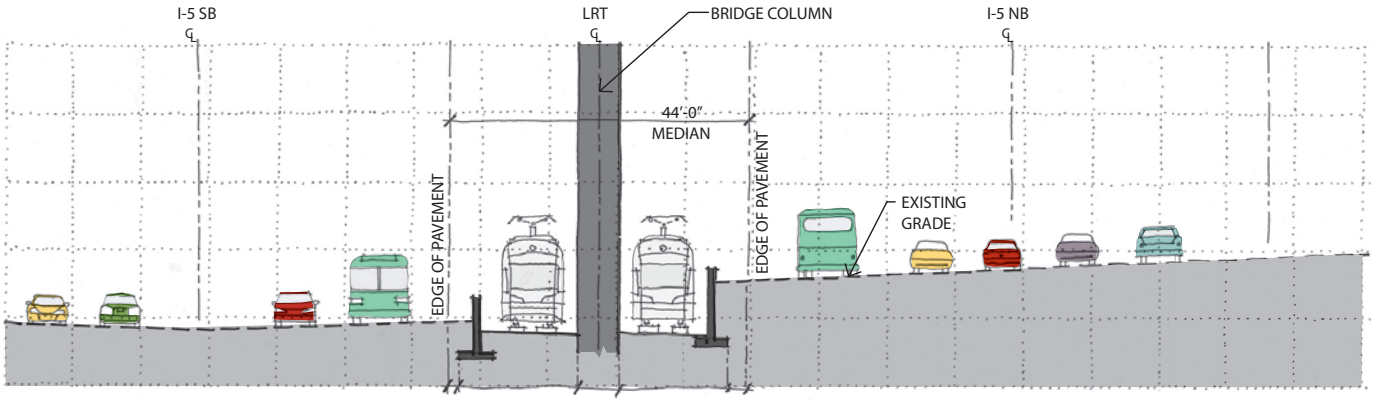


Figure 4-10. L1: I-5 Light Rail Alternative - Typical Cross-section of At-grade Rail in Median of Roadway

NE 185TH STREET TO MOUNTLAKE TERRACE TRANSIT CENTER

The alignment for this segment begins north of the NE 185th Street station. It would continue in a mix of elevated and at-grade profiles to 236th Street SW, where it would arrive at the Mountlake Terrace Transit Center. An aerial station would be located over 236th Street SW, with station entrances on the south and north sides of 236th Street SW, and would serve the Mountlake Terrace Transit Center, park-and-ride garage, and freeway station. The aerial station is assumed to be center platform with a ground-level plaza. The Mountlake Terrace Station includes the following:

- Two off-street in-service bus bays and six off-street layover bus bays at the Mountlake Terrace Transit Center
- To maintain the existing parking supply a new parking garage with approximately 230 parking spaces to replace existing surface parking that would be displaced by the expanded and relocated off-street transit center

MOUNTLAKE TERRACE TRANSIT CENTER TO LYNNWOOD TRANSIT CENTER

The alignment for this segment begins at the Mountlake Terrace Transit Center and continues north on an elevated structure, crossing over the northbound lanes of I-5, entering the freeway median, and dropping to grade. The alignment continues at-grade in the median of I-5 to just south of Lynnwood, where it transitions back to aerial structure and passes over the southbound freeway lanes to reach the existing Lynnwood Transit Center. An aerial station is located on the south side of the Lynnwood Transit Center oriented either east-west in the 202nd Street SW right-of-way or north-south in the 46th Avenue West right-of-way. This station is assumed to be center platform with a ground level plaza connecting to the Lynnwood Transit Center. The Lynnwood Transit Center Station includes the following:

- Additional park-and-ride garage of 500 spaces, for a total of approximately 1,900 spaces at the Lynnwood Transit Center
- Pedestrian bridge connection from the station to the east side of 44th Avenue West to access the city center area
- Two additional off-street layover bays
- A sufficient number of in-service bus bays

4.3.2 Service Plan

Light rail service includes operation of up to four-car trains serving stations at Northgate Transit Center, NE 145th Street, NE 185th Street, Mountlake Terrace Transit Center, and Lynnwood Transit Center. Service would be provided 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes. Headways were determined based on service levels required to meet estimated ridership demand.

No changes are proposed for Community Transit local routes except for minor adjustments to Route 112 to serve the Mountlake Terrace Transit Center. Local King County Metro routes in north King County would be adjusted to serve light rail. Existing routes would either be truncated or extended to serve the new light rail stations at NE 145th Street, NE 185th Street, and the Mountlake Terrace Transit Center. All of Community Transit's south Snohomish County commuter routes to the University of Washington and downtown Seattle would be restructured to terminate at the Lynnwood, Mountlake Terrace, or 185th Street light rail stations. None of the existing 800 or 400 series routes from south Snohomish County would continue south of 185th Street in Shoreline. North Snohomish County commuter routes would continue to operate unchanged from today's operations.

Most Sound Transit and Community Transit routes from south Snohomish County that operate to Seattle would terminate in Lynnwood where passengers would transfer to light rail. The exceptions are routes that currently originate in Edmonds and provide service to downtown Seattle and the University District. These routes would terminate at the Mountlake Terrace and Shoreline Park-and-Ride Stations where passengers would transfer to light rail.

King County Metro commuter routes connecting north King County with downtown Seattle, Overlake, and the University District (e.g., 242, 301, and 304) would be modified or discontinued and replaced with modified routes that would provide connections to the light rail stations at Northgate, NE 145th Street, and NE 185th Street.

4.4 L2: SR 99 MIXED PROFILE LIGHT RAIL ALTERNATIVE

The L2: SR 99 Mixed Profile Light Rail Alternative advanced to the Level 2 evaluation is similar in concept to the L2: SR 99 Light Rail Alternative assessed as part of the Level 1 evaluation. This alternative would include a combination of elevated and at-grade double-track rail line from Northgate to the Lynnwood Transit Center with four intermediate stations. The general scope of work includes:

- Capacity for new light rail fleet and O&M facility, as needed, to support the extension
- New at-grade light rail stations located at North 130th Street and North 160th Street, as well as new elevated light rail stations at the Shoreline Park-and-Ride (North 192nd Street), Mountlake Terrace Transit Center, and Lynnwood Transit Center
- Five hundred new structured park-and-ride stalls at both the Shoreline Park-and-Ride and Lynnwood Transit Center, supplementing approximately 2,600 existing stalls along the alignment
- Restructured bus services to integrate existing service with new light rail service and to avoid duplication of transit service on SR 99
- Relocation of the transit functionality of the Aurora Village Transit Center to the Shoreline Park-and-Ride, including 16 bays for in-service and layover operations

- Additional in-service and/or layover bus bays at the Mountlake Terrace Park-and-Ride and the Lynnwood Transit Center to accommodate restructured bus services

Early in the Level 2 alternatives development process, a major change was made to this alternative from the concept evaluated during Level 1. A decision was made to change from peak period operation of four-car trains at 4-minute headways to peak operation at 8-minute headways. This decision was based on analysis of traffic operations along SR 99 and the lessons learned to date as a result of at-grade median light rail operations along Martin Luther King Jr. Way in the city of Seattle.

The Level 1 evaluation had indicated some potential for traffic congestion along the at-grade sections of the SR 99 alignment, so work was undertaken early in the refinement of the Level 2 alternatives to better understand the possible impacts. At-grade light rail operating in the median of SR 99 would require trains to pass through a number of signalized intersections, exposing them to delays that would not occur with a completely grade-separated alignment. The affected SR 99 traffic signals can be timed to provide varying levels of priority for light rail, with the trade-off being the resulting delay to roadway traffic. Complete pre-emption of the signals for the train movements (i.e., the signals turn green to facilitate the train movement and stop all conflicting traffic) would result in significant impacts to conflicting traffic movements.

Sound Transit's experience on Martin Luther King Jr. Way in Seattle is that full signal pre-emption for median running light rail is not practical along a major arterial. Instead, at grade median running light rail typically operates with traffic signal *priority* as opposed to *pre-emption*, and trains would need to stop at some signals with some unpredictability. It is not known what the policies of the cities of Seattle and Shoreline and WSDOT will be toward the operation of SR 99, but given the high cross-street and left-turn traffic volumes, full pre-emption for light rail does not seem practical. Analysis of intersections along SR 99 indicates that many will be operating at LOS F (i.e., highly congested) by 2030. The traffic added as a result of the consolidation of left turns and other traffic relocations, along with the addition of a four-car train every 2 minutes, would further worsen these highly congested conditions. If trains are provided a high level of priority through these intersections severe traffic impacts would result, especially to cross-street and left-turn movements.

Micro-simulation traffic modeling of SR 99 indicates that, while light rail operations could be fine-tuned to work with 4-minute headways, highly congested and unstable traffic conditions would result. These conditions would lead to a high probability of unpredictable train delays. When combined with the short train headways, schedule recovery from these delays would be difficult. Another factor in determining the train headways that can be reliably maintained is how this segment fits within the regional rail network. Figure 4-11 illustrates the planned light rail system configuration once extensions are completed east to Overlake in Redmond, south to South 200th Street in SeaTac, and north to Lynnwood. As can be seen, the system would operate with two lines—one from Lynnwood to South 200th Street and one from Lynnwood to Overlake. Both lines would operate at 8-minute peak period headways resulting in 4-minute peak headways between the junction at the south end of the Seattle CBD and Lynnwood, which requires every train operating in the system to traverse the segment between Northgate and

Lynnwood. Ridership forecasting completed as part of the system plan development indicates that this level of service, at least south of Lynnwood, is needed to accommodate forecasted demand. As a result, any delays incurred in the segment between Northgate and Lynnwood would affect the operation of the entire light rail system. This problem becomes worse when the system is eventually built north to Everett, south to Tacoma, and east to downtown Redmond.

As a result, it was determined that 4-minute headway operation through signalized intersections along this portion of SR 99 was neither prudent nor practical. Instead, a decision was made to turn back the Overlake trains at Northgate and only continue the South 200th Street trains on to Lynnwood. This configuration increases the headways along SR 99 to a more comfortable 8-minute operation.

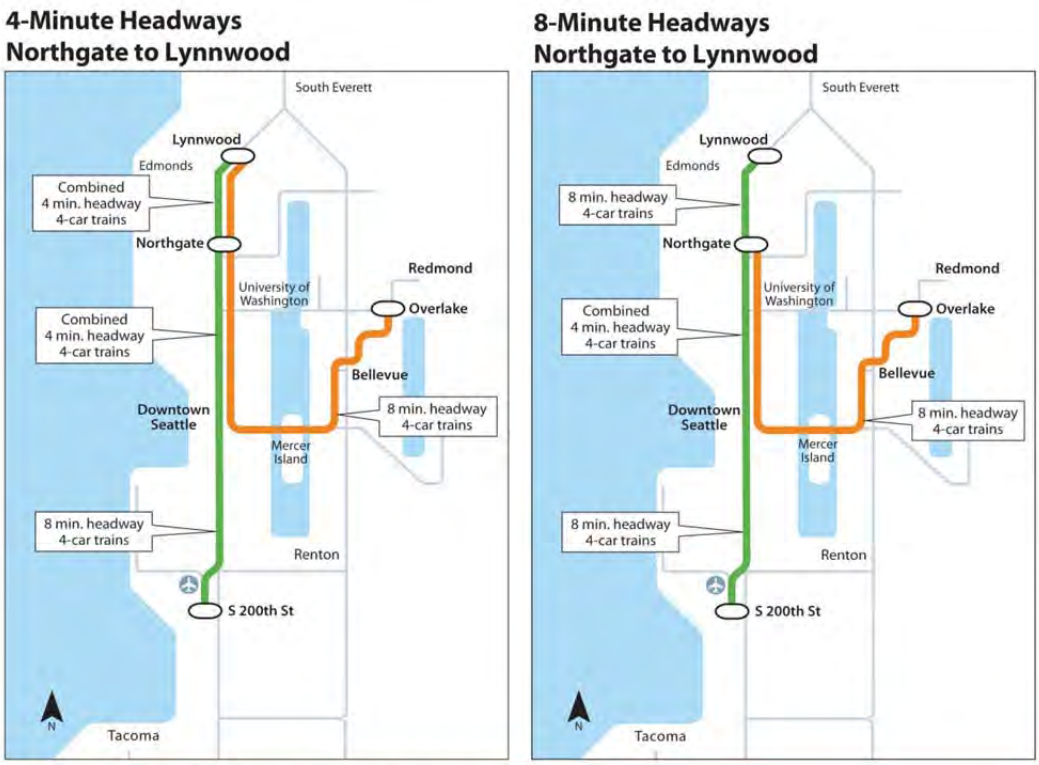


Figure 4-11. 4- and 8-Minute System Operating Plans

4.4.1 Facility Design

Figure 4-12 provides an overview of the alternative showing the primary alignment and two possible variations—one at the south and one at the north end. Figures 4-13 through 4-16 provide more detail regarding the alignment, profile, and station locations. The proposed L2: SR 99 Mixed Profile Light Rail Alternative is approximately 10.2 miles in length from the Northgate Transit Center to the Lynnwood Transit Center. Potential right-of-way acquisitions would be required along the majority of the alignment, and would be quite large for the at-grade sections and stations (50 to 90 feet of new right-of-way would be required). Because the at-grade alignment passes through intersections along SR 99, the conceptual design approach was to maintain traffic functionality and level of service existing in baseline conditions. This would require maintaining the existing through lanes and BAT lanes, as well as adding new left-turn lanes to accommodate consolidated left-turn volumes. This would result in dual left-turn lanes at many intersections. At station locations, the left-turn lanes are placed outside of the station platforms, resulting in a relatively extensive total roadway and trackway width (up to 190 feet). Figure 4-16 shows a typical cross-section of the existing SR 99 between North 110th Street and North 145th Street. Figures 4-17 and 4-18 illustrate typical examples of the resulting cross-sections for a mid-block at-grade rail guideway location and an at-grade rail station location, respectively. As the design of the line is refined, details for roadway improvements, as well as passenger drop-off facilities, local bus transfers, and street and traffic signal improvements around the stations will be further investigated. Refinement of the pedestrian connectivity infrastructure will also need to be considered. For the purposes of developing conceptual cost estimates, it was also assumed there would be one track crossover in the vicinity of each station.

NORTHGATE TRANSIT CENTER TO NORTH 130TH STREET

The alignment begins at the north end of the planned Northgate Link station tail tracks in the Northgate Mall parking lot east of 1st Avenue NE. The aerial alignment continues north and then turns west, crossing over I-5, and continuing on aerial structure along the south side of Northgate Way. As Northgate Way turns southwest, the alignment would cross over the street and continue west generally along North 110th Street on the south edge of the Evergreen Washelli Cemetery. A section of this alignment may be at-grade, but most of it would be aerial. North 110th Street would be reconstructed to reconnect the local streets through this segment.

Near SR 99, the aerial alignment would curve to the south and then north to cross the northbound lanes and enter the median of SR 99. The aerial alignment would continue north in the median of SR 99 to about North 120th Street to minimize impacts to the adjacent cemetery. Throughout this section, the existing SR 99 roadway lane configuration would be maintained, with the exception of the center two-way left-turn lane that would be used for the column supports and to provide left-turn pockets for business access. North of North 120th Street, the alignment would transition to at-grade and SR 99 would be widened to the east to provide space for the guideway in the median.

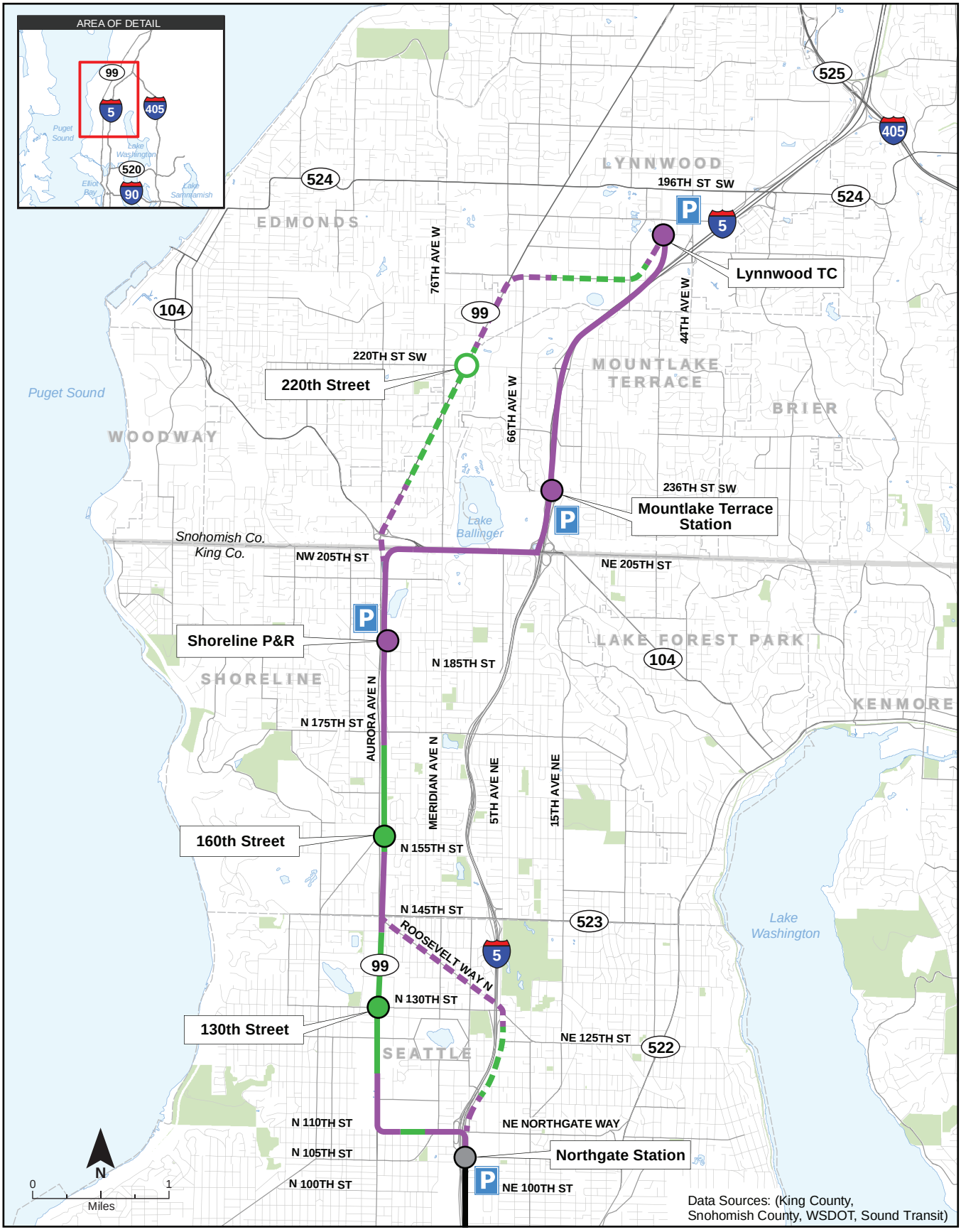


Figure 4-12. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative

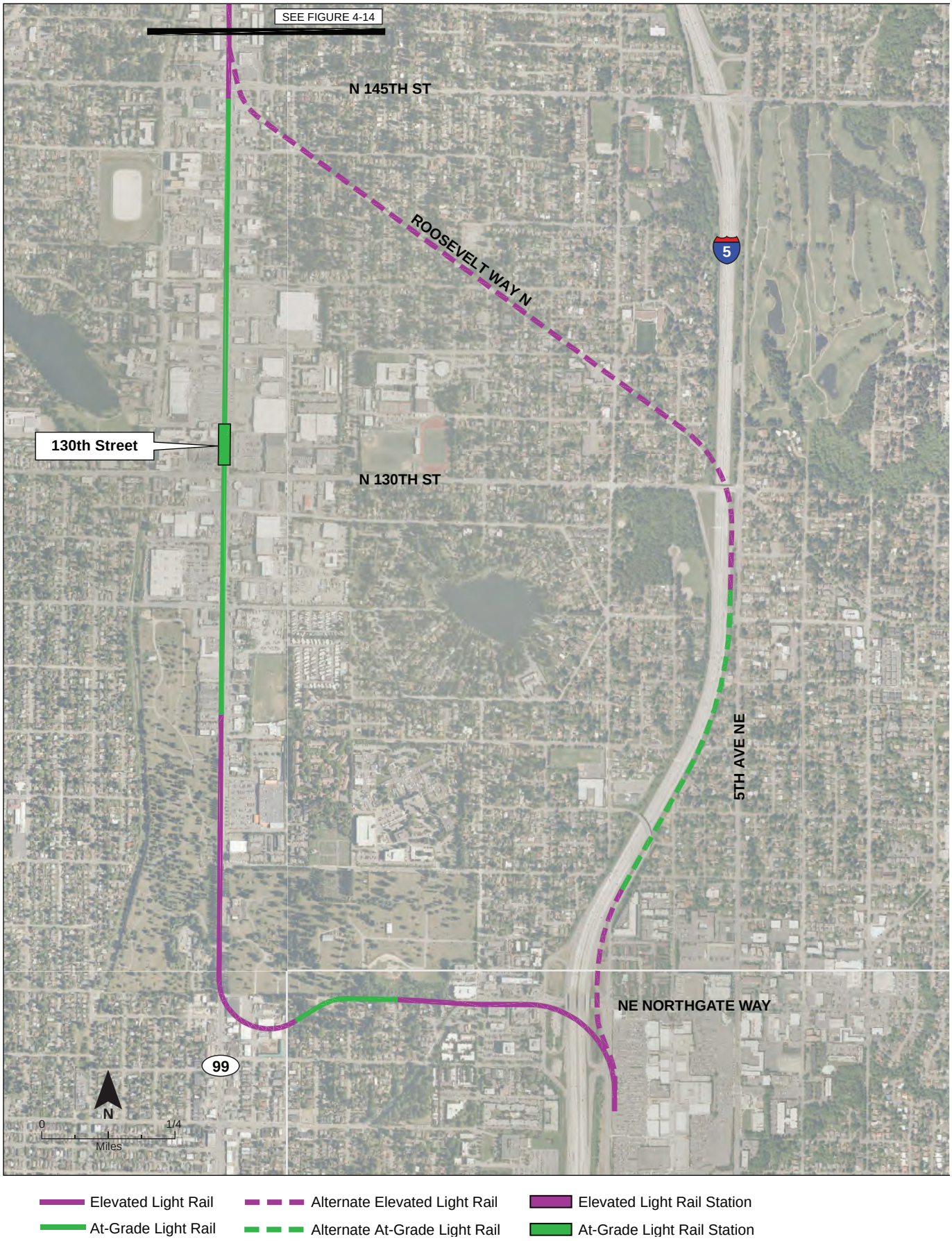


Figure 4-13. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail - 1 of 4

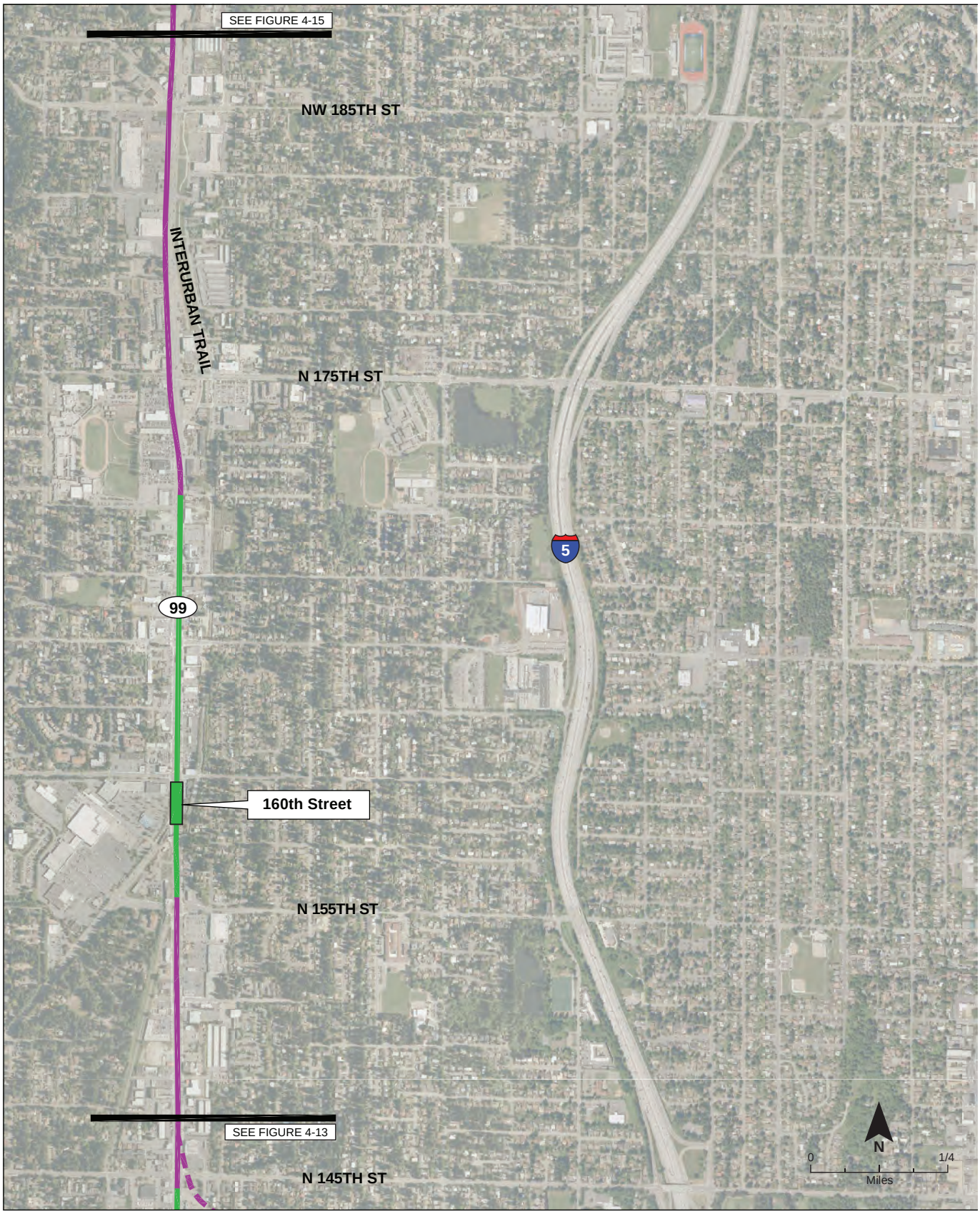


Figure 4-14. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail - 2 of 4

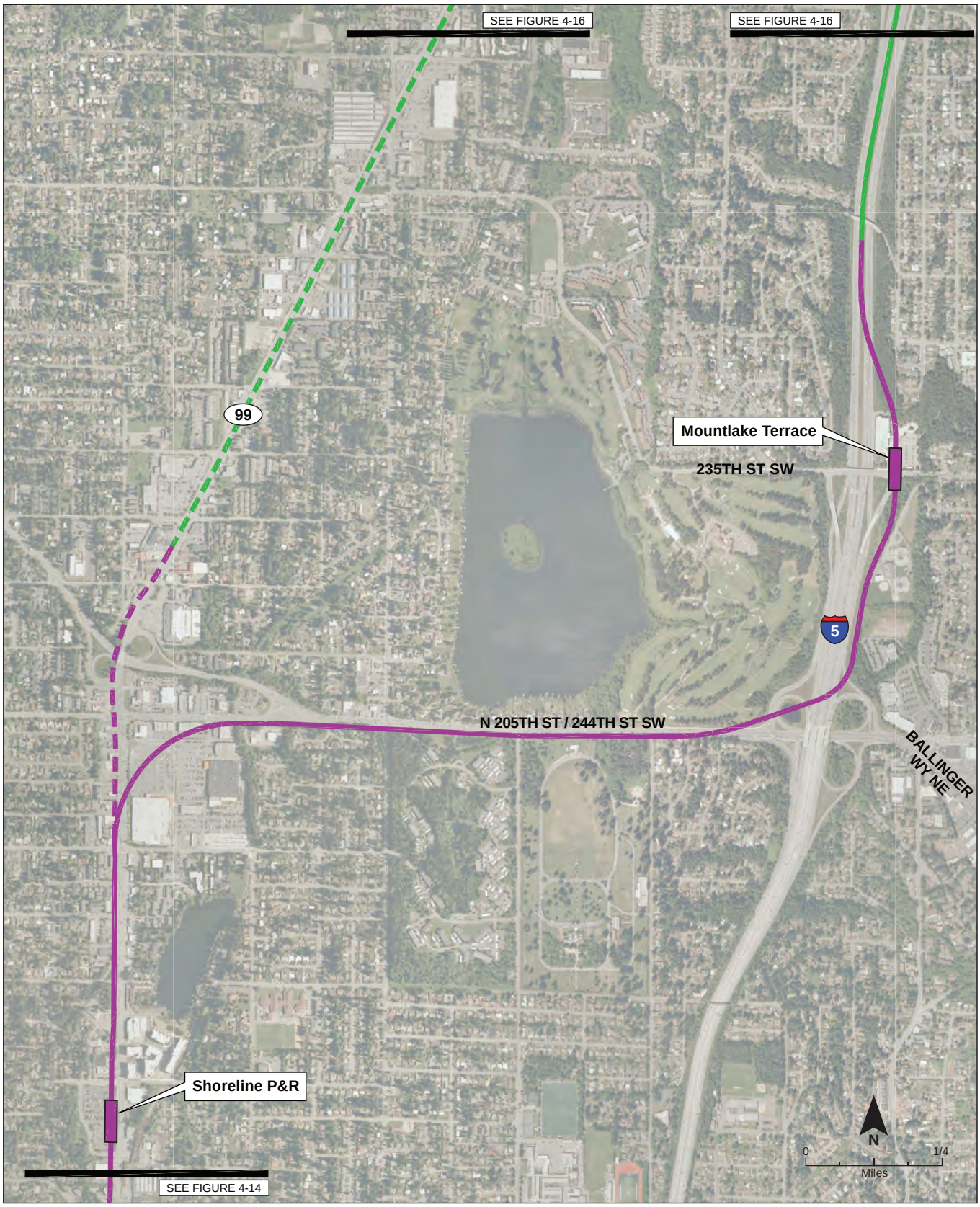


Figure 4-15. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail - 3 of 4

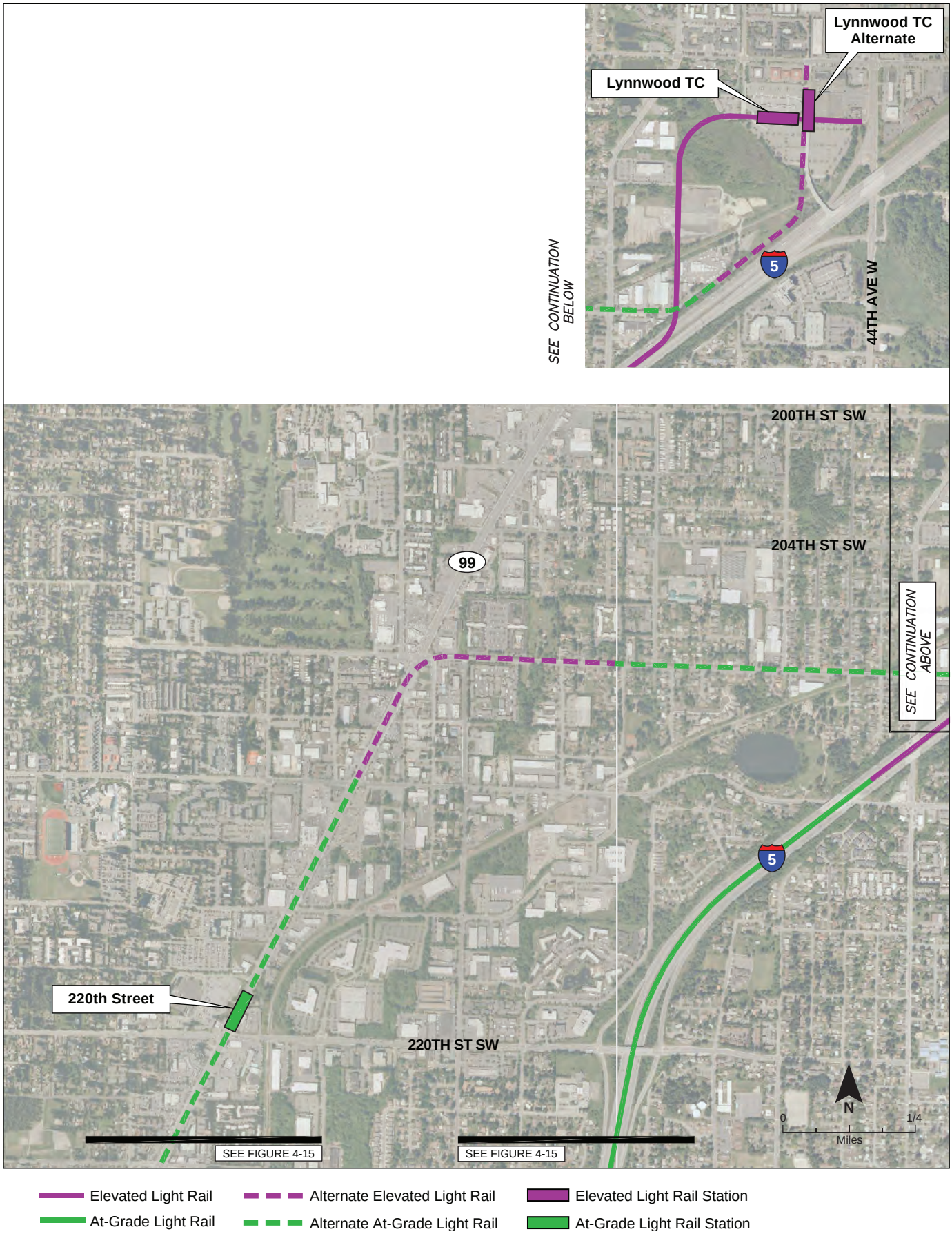


Figure 4-16. Level 2 L2: SR 99 Mixed Profile Light Rail Alternative Detail - 4 of 4

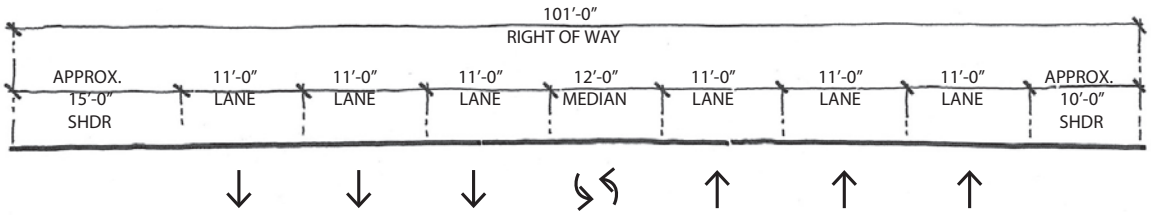


Figure 4-17. Existing SR 99 Typical Cross-section

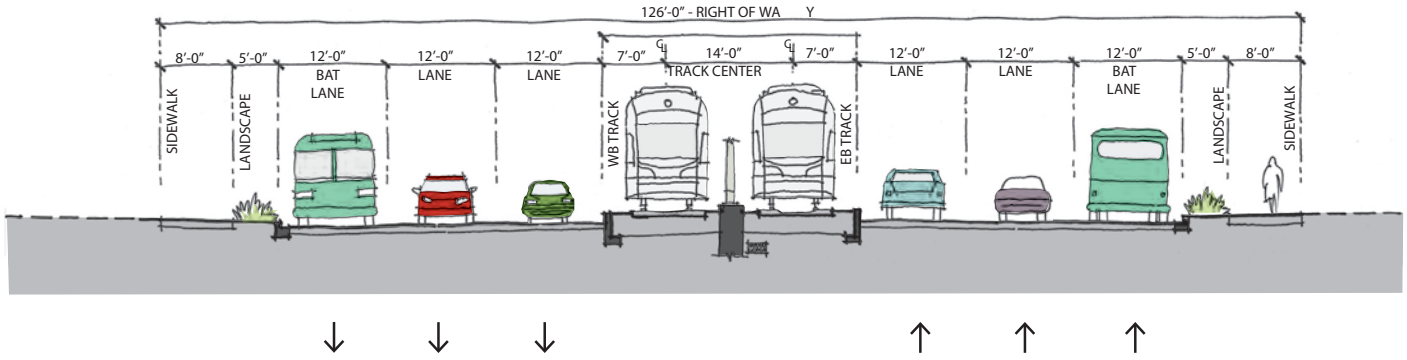


Figure 4-18. L2: SR 99 Mixed Profile Light Rail Alternative Typical At-grade Mid-block Cross-section

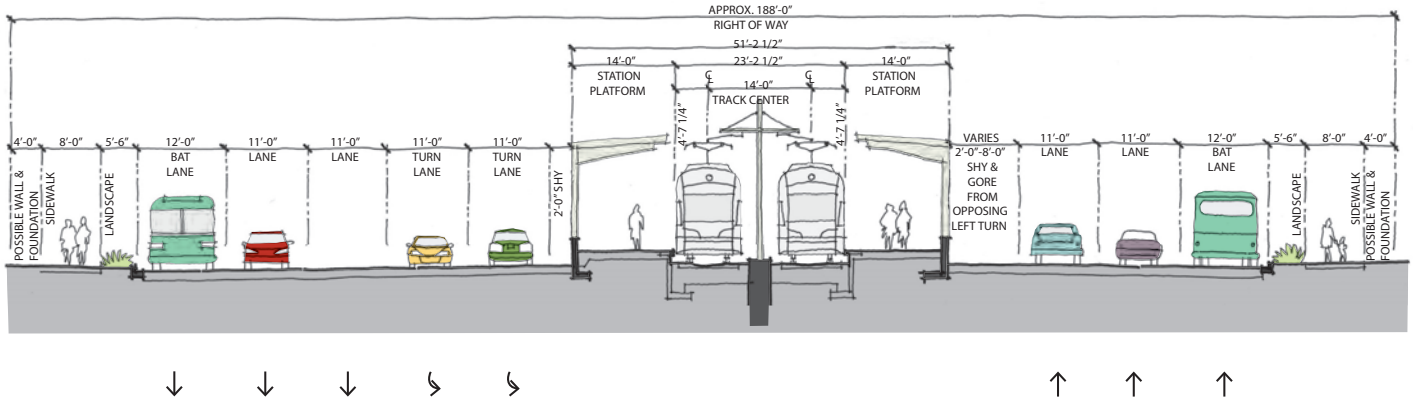


Figure 4-19. L2: SR 99 Mixed Profile Light Rail Alternative At-grade Cross-section at Intersection with Station

An at-grade station would be located just north of North 130th Street. The station would be located in the median of SR 99 with side platforms, and have a total width of approximately 60 feet and length of approximately 380 feet.

NORTH 130TH STREET TO NORTH 160TH STREET

North of the 130th Street Station, the at-grade alignment continues in the center of SR 99 to approximately North 143rd Street, where it would transition to an elevated guideway to cross over the heaviest traffic intersections at North 145th Street and North 155th Street. The alignment would then shift back to at-grade just north of North 155th Street, where a station would be located at North 160th Street. Portions of the Interurban Trail, including the pedestrian bridge over SR 99, would require reconstruction.

The at-grade station at North 160th Street would be located in the median of SR 99 with side platforms, and have a total width of approximately 60 feet and length of approximately 380 feet.

NORTH 160TH STREET TO SHORELINE PARK-AND-RIDE

North of the 160th Street Station, the alignment continues at-grade in the SR 99 median to approximately North 173rd Street, where it transitions to an elevated structure. The elevated guideway crosses from the median to the west side of SR 99, passing over the high-volume intersections of North 175th Street and North 185th Street. The elevated guideway continues on the west side of SR 99 to an elevated station at the Shoreline Park-and-Ride (North 192nd Street). The light rail station at the existing Shoreline Park-and-Ride would include all of the functions now provided by the Aurora Village Transit Center. The latter would be re-located to the light rail station and the existing site of the Aurora Village Transit Center could be redeveloped. The Shoreline Park-and-Ride Station includes the following:

- Elevated pedestrian walkway between the existing Shoreline Park-and-Ride and the light rail station
- Sixteen bays for in-service and layover operations to replace the existing Aurora Village Transit Center
- An 1,100-stall parking garage to replace the existing 400 parking spaces at the Shoreline Park and Ride and the 200 existing spaces at the Aurora Village Transit Center, plus an additional 500 parking spaces

SHORELINE PARK-AND-RIDE TO MOUNTLAKE TERRACE TRANSIT CENTER

North of the Shoreline Park-and-Ride Station, the elevated alignment continues along the west side of SR 99. Near the King/Snohomish County line, the aerial structure turns east, and then crosses over SR 99 and the parking lots and commercial properties near the intersection of SR 99 and North 205th Street (SR 104). The alignment continues eastward along the south side of SR 104, crossing over Meridian Avenue, 1st Avenue NE, 5th Avenue NE, SR 104, and I-5. This route would cross I-5 in a straight alignment to simplify structural requirements, and then curve north through office and school properties south of 236th Street SW. An aerial station would be located

over 236th Street SW, with station entrances on the south and north sides of 236th Street SW. This aerial station would serve the Mountlake Terrace Transit Center, park-and-ride garage, and freeway station. The aerial station is assumed to be center platform with a ground-level plaza. The Mountlake Terrace Station includes the following:

- Two off-street in-service bus bays and six off-street layover bus bays at Mountlake Terrace Transit Center
- A new parking garage with approximately 230 parking spaces to replace existing surface parking that would be displaced by the expanded and relocated off-street transit center

MOUNTLAKE TERRACE TRANSIT CENTER TO LYNNWOOD TRANSIT CENTER

The alignment in this segment is identical to that described in Section 4.3.1 for the L1: I-5 Light Rail Alternative.

4.4.2 Alignment Variations

As shown in Figure 4-8, two alignment variations are under consideration for this alternative. The first provides an alternative connection between Northgate and SR 99. Instead of following Northgate Way and North 110th Street, the alternative alignment would continue along the east side of I-5 to approximately NE 130th Street, where it would cross over I-5 on an elevated structure and continue elevated along Roosevelt Way North to SR 99. This alignment alternative would preclude a station at North 130th Street. While a tunnel configuration also was given initial consideration for this section, the tunnel option was dropped following the Level 1 evaluation. As discussed in Chapter 3, with other non-tunnel alignments appearing to perform equal or better, further consideration of very costly tunnel alignments was dropped.

The second alignment variation would continue north of the King County/Snohomish County line at NW 205th Street/244th Street SW rather than turning east to follow SR 104 to I-5. From the station at the Shoreline Park-and-Ride, the alignment would continue elevated on the west side of SR 99, crossing over 244th Street SW and SR 104 before transitioning to at-grade in the median of SR 99 at approximately 240th Street SW. The alignment would then follow SR 99 at-grade to an at-grade station at 220th Street SW. At 208th Street SW, the alignment would transition to an elevated structure to cross over the northbound lanes of SR 99 and turn east onto 208th Street SW. On 208th Street SW, the alignment would transition from aerial back to at-grade in the median of the street and follow 208th Street SW to I-5. It would then transition back to aerial just prior to I-5 and turn northeast and continue along the west side of the I-5 right-of-way to Lynnwood Transit Center. Because of the constrained existing right of-way, this alignment would require substantial property acquisitions along the north side of 208th Street SW. In order to provide circulation and access to residents along the road, it is assumed that four signalized intersections allowing crossings of the rail guideway would be provided as well.

Finally, short sections of the former Interurban right-of-way that parallels SR 99 in King and Snohomish Counties might be crossed or used for the light rail alignment. While an alignment that requires continuous use of large segments of the Interurban right-of-way was dropped from consideration based on the findings from the initial screening (discussed in Chapter 3), it is

possible that using smaller portions of the right-of-way could be reconsidered if sections of a SR 99 route prove more difficult, but not as a major route alignment option.

4.4.3 Service Plan

Light rail service includes four-car trains serving stations at the Northgate Transit Center, North 130th Street, North 160th Street, Shoreline Park-and-Ride, Mountlake Terrace Transit Center, and Lynnwood Transit Center. Service would be provided 20 hours per day, with peak headways of 8 minutes and off-peak headways of 10 minutes.

Community Transit routes that now serve the Aurora Village Transit Center would be extended south on SR 99 to serve the new Shoreline Transit Center and light rail station. Similarly, King County Metro routes that now serve the Aurora Transit Center would be truncated at the new Shoreline Transit Center and light rail station.

Local King County Metro routes in north King County would be adjusted to serve light rail. Existing routes would either be truncated or extended to serve the new light rail stations at North 130th Street, North 160th Street, Shoreline Park-and-Ride, and Mountlake Terrace Transit Center.

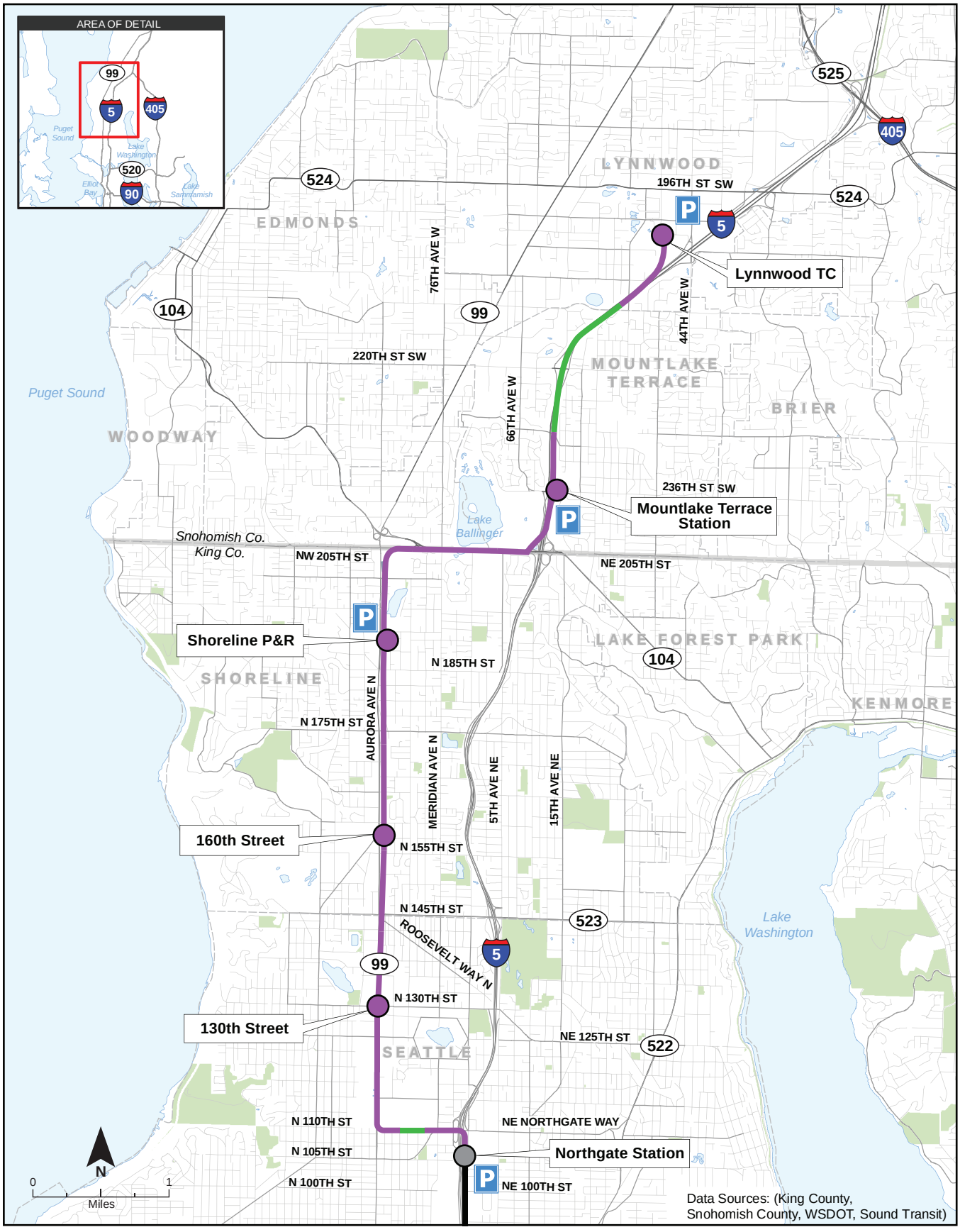
All Sound Transit routes from Snohomish County that operate to Seattle would terminate in Lynnwood, where passengers would transfer to light rail. Community Transit I-5 commuter routes connecting south Snohomish County to downtown Seattle and to the University of Washington would continue to operate as they do today, with the exception of routes currently connecting Edmonds with Seattle. These routes would terminate at the Mountlake Terrace and Shoreline Park-and-Ride stations where passengers would transfer to light rail. North Snohomish County commuter routes would continue to operate unchanged from today's configuration. King County Metro Route 301 would be discontinued and Route 304 would be truncated at the North 160th Street Station.

King County Metro RapidRide E Line BRT would interface with Community Transit's *Swift* BRT service at the Shoreline Park-and-Ride Station, which would be the terminus for both BRT services.

4.5 L3: SR 99 ELEVATED LIGHT RAIL ALTERNATIVE

The L3: SR 99 Elevated Light Rail Alternative has a similar alignment to the L2: SR 99 Mixed Profile Light Rail Alternative with the exception that the entire section of the alignment along SR 99 would be elevated. The difference between the L2 and L3 alignments occurs in the section between approximately North 120th Street and North 175th Street. Also, in contrast with the L2: SR 99 Mixed Profile Light Rail Alternative, the elevated alignment along SR 99 would allow for operations at 4-minute headways during peak periods. This alternative overall would include a combination of elevated and at-grade double-track rail line from Northgate to the Lynnwood Transit Center with four intermediate stations. Figure 4-20 provides an overview of the alternative showing the primary alignment and two possible variations—one at the south and one at the north end. Figures 4-21 through 4-24 provide more detail regarding the alignment, profile, and station locations. The general scope of work includes:

- Capacity for new light rail fleet and O&M facility, as needed, to support the extension
- New elevated light rail stations located at North 130th Street, North 160th Street, Shoreline Park-and-Ride (North 192nd Street), Mountlake Terrace Transit Center, and Lynnwood Transit Center
- Five hundred new structured park-and-ride stalls at both the Shoreline Park-and-Ride and Lynnwood Transit Center, supplementing approximately 2,600 existing stalls along the alignment
- Restructured bus services to integrate existing service with new light rail service and to avoid duplication of transit service on SR 99
- Relocation of the transit functionality of the Aurora Village Transit Center to the Shoreline Park-and-Ride, including 16 bays for in-service layover operations
- Additional in-service and/or layover bus bays at Mountlake Terrace Park-and-Ride and Lynnwood Transit Center to accommodate restructured bus services



Elevated Light Rail
At-Grade Light Rail
Elevated Light Rail Station
North Link Light Rail
North Link Station
Parking Available at Station

Figure 4-20. L3: Level 2 SR 99 Elevated Light Rail Alternative

4.5.1 Facility Design

The L3: SR 99 Elevated Light Rail Alternative is approximately 10.2 miles (Northgate Transit Center to the Lynnwood Transit Center) in length. The following subsections describe the major components that form a potential light rail line along the SR 99 alignment between the Northgate Transit Center and the Lynnwood Transit Center. Line segments and stations are included in these descriptions. Light rail vehicles and the O&M facility capacity to support the light rail line are not included in these descriptions and are the subjects of a separate system wide study that Sound Transit is now undertaking. As the design of the line is refined, requirements for these types of improvements, as well as passenger drop-off facilities, local bus transfers, and street and traffic signal improvements around the stations will be further investigated. Figure 4-25 shows a typical cross-section of the existing SR 99 between North 110th Street and North 145th Street. Figures 4-25 and 4-26 illustrate typical examples of the resulting cross-sections for a mid-block elevated rail guideway location and an elevated rail station location, respectively. Refinement of the pedestrian connectivity infrastructure will also need to be considered. Other design features assumed in the capital cost estimates include one track crossover in the vicinity of each station.

The L3: SR 99 Elevated Light Rail Alternative alignment assumes the elevated guideway is located on the west side of SR 99 north of North 120th Street. Alternatively, the alignment could be located either in the median or on the east side of SR 99, though either one would have consequences. An elevated guideway in the median of SR 99 would require significant roadway reconstruction and widening to accommodate left-turn demand at each signalized intersection. Median placement would result in traffic impacts because the current two-way left-turn lane would be removed to make space available for column placement. All left turns and U-turns would be consolidated at the signalized intersections, adding to the amount of roadway reconstruction. The cost and complexity of stations would also increase because either a mezzanine level or street level plaza would be required in the median below the passenger platform. For these reasons, a median elevated guideway was not used in this analysis.

A cursory evaluation suggests that there are not significant differences in the guideway impacts if it is located on the east side instead of the west side. However, both the 160th Street and Shoreline Park-and-Ride stations appear to be better situated on the west side of SR 99. At 160th Street, existing commercial and high-density residential land uses are located on the west side. The existing Shoreline Park-and-Ride provides a location on the west side that can be redeveloped with an expanded transit center. For these reasons, a "primary" alignment was chosen for the purposes of the Level 2 evaluation that runs along the west side of SR 99. However, analysis of this specific alignment for the Level 2 evaluation does not preclude future assessment of alignment variations.

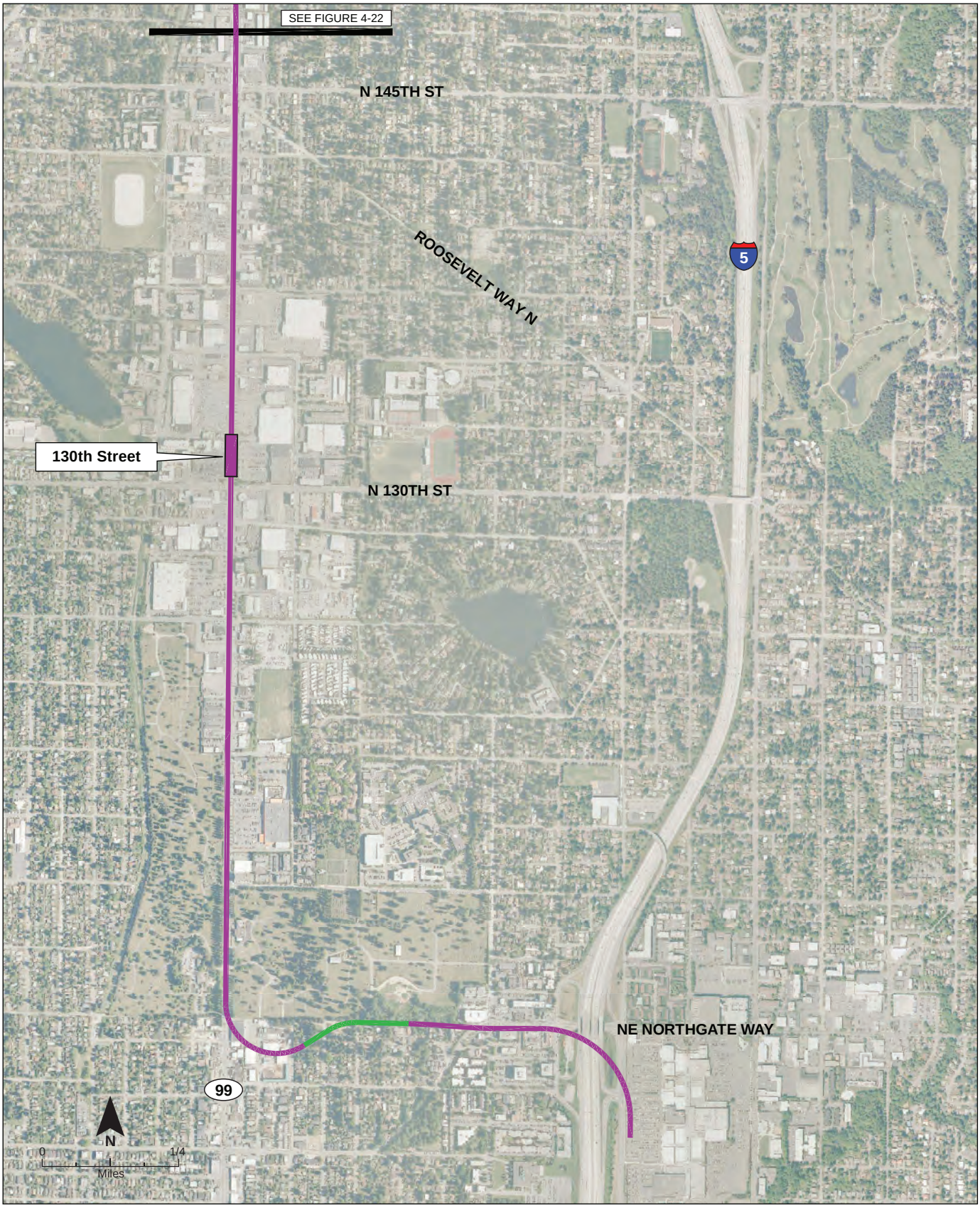


Figure 4-21. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail - 1 of 4

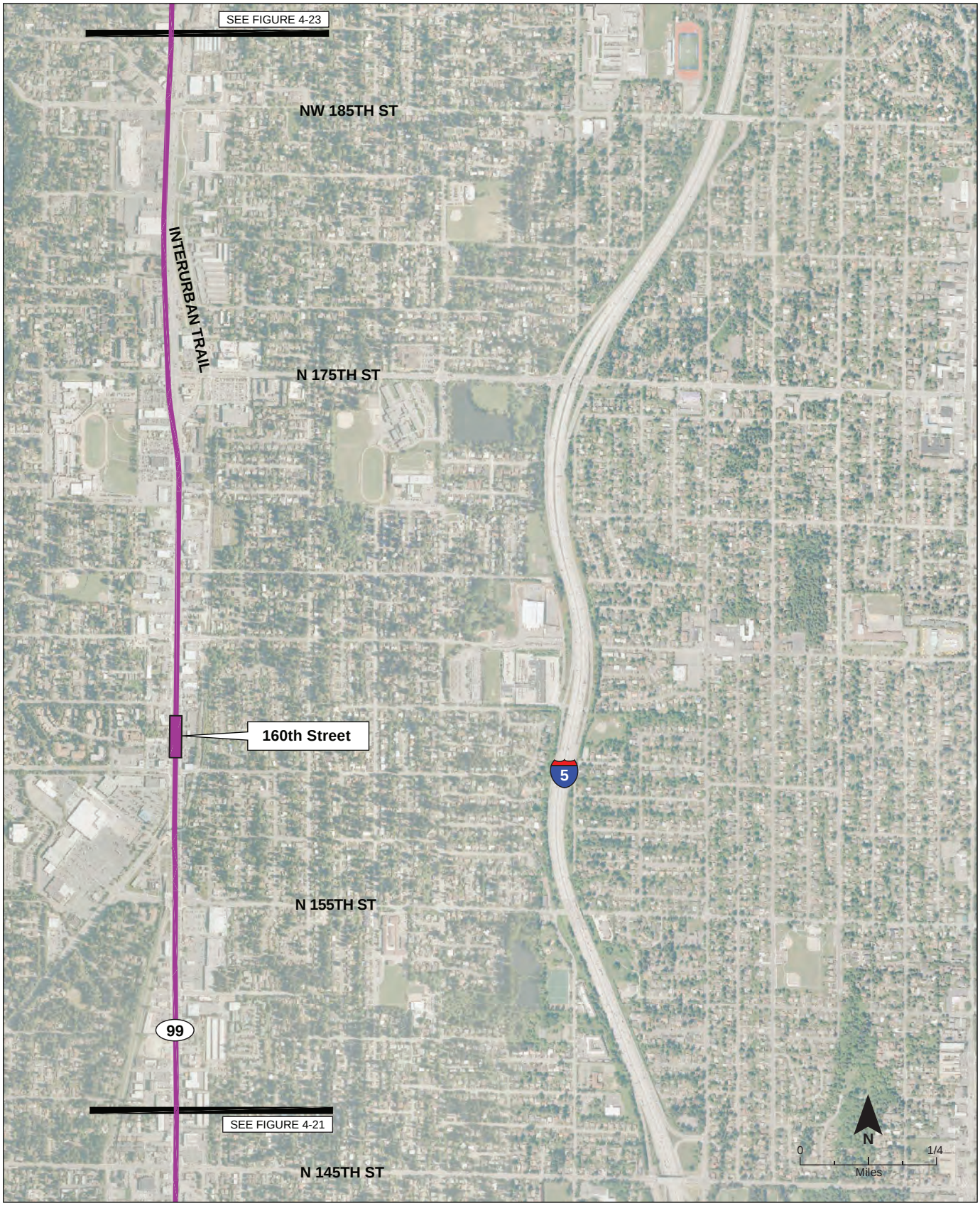


Figure 4-22. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail - 2 of 4

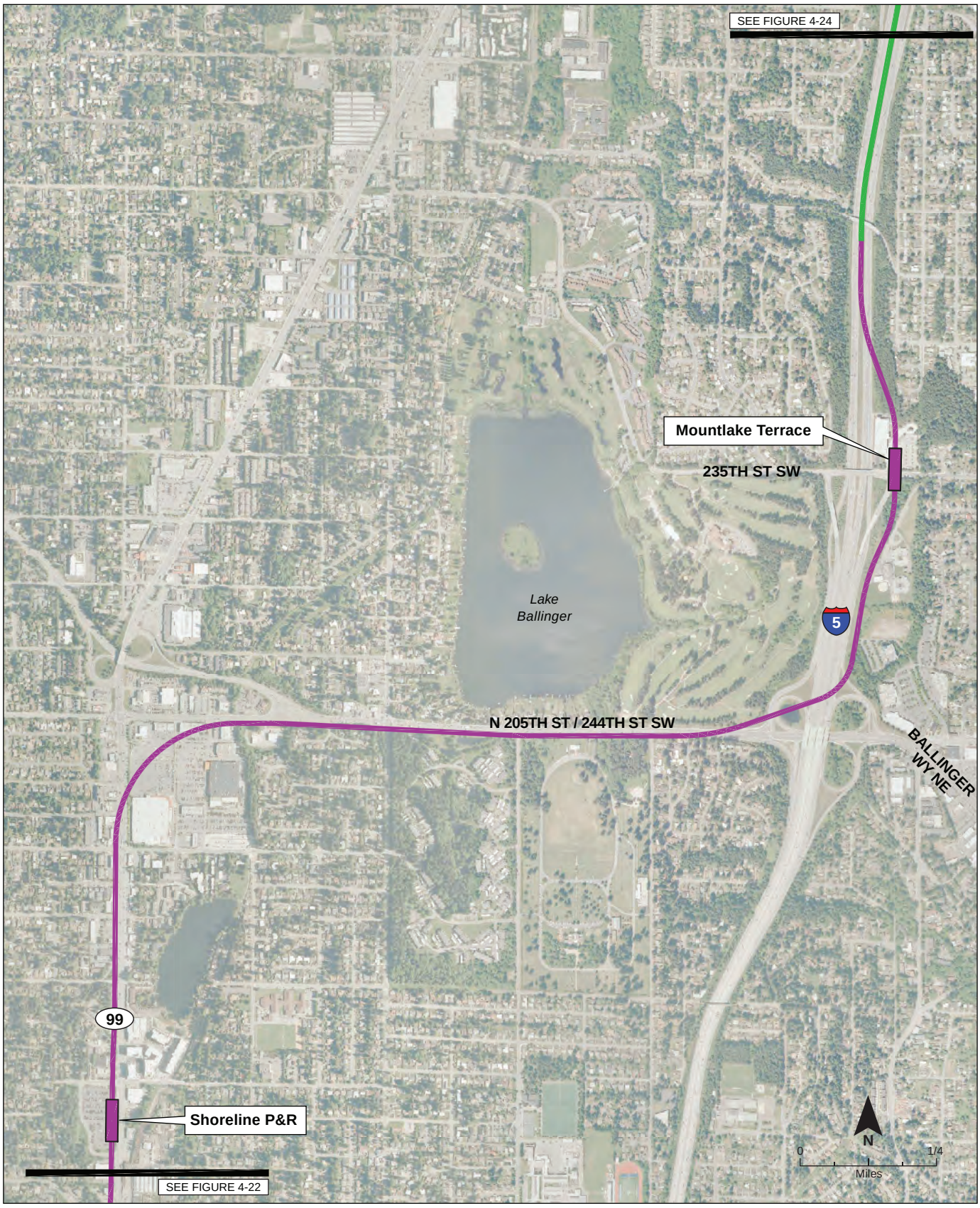


Figure 4-23. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail - 3 of 4

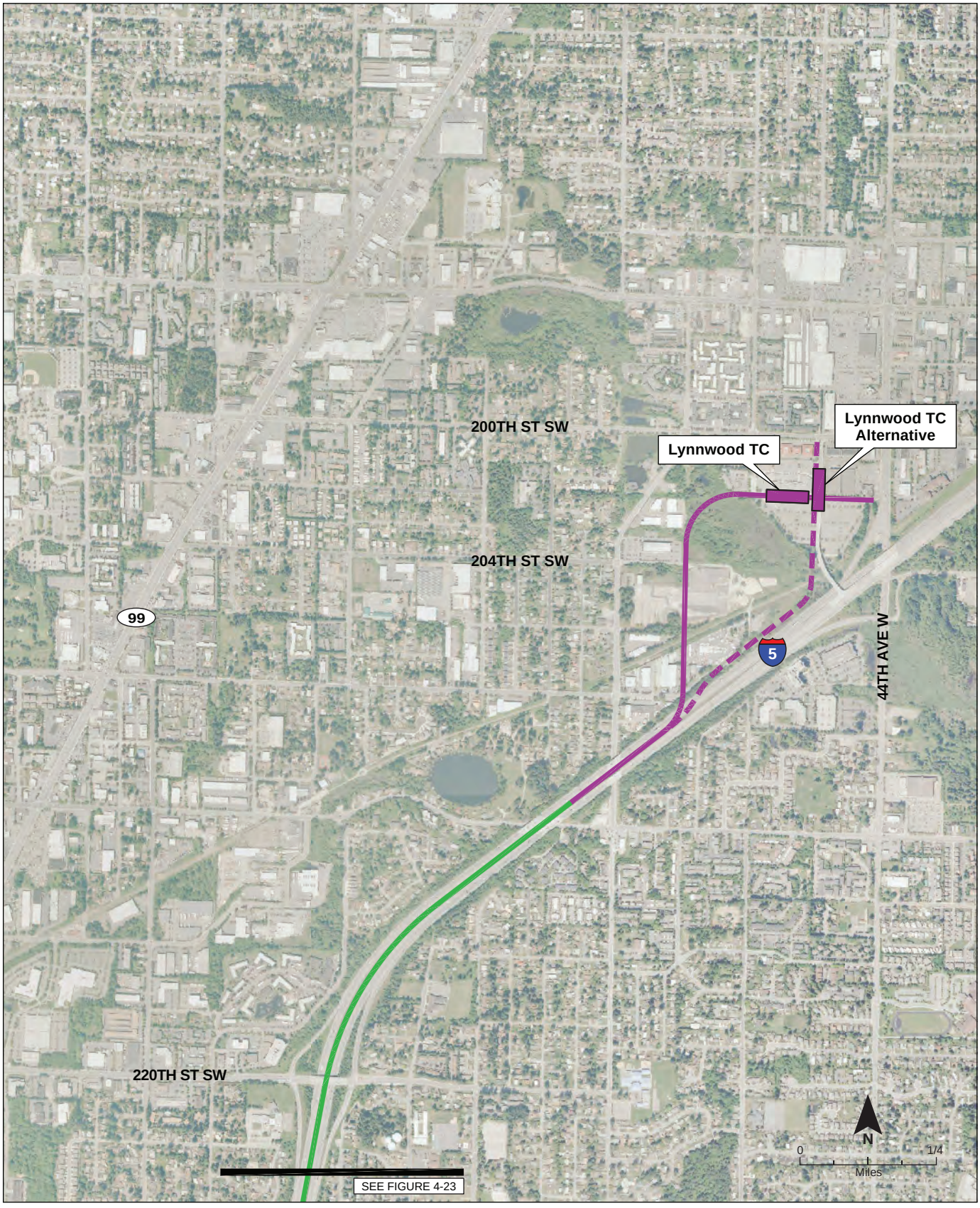


Figure 4-24. L3: Level 2 SR 99 Elevated Light Rail Alternative Detail - 4 of 4

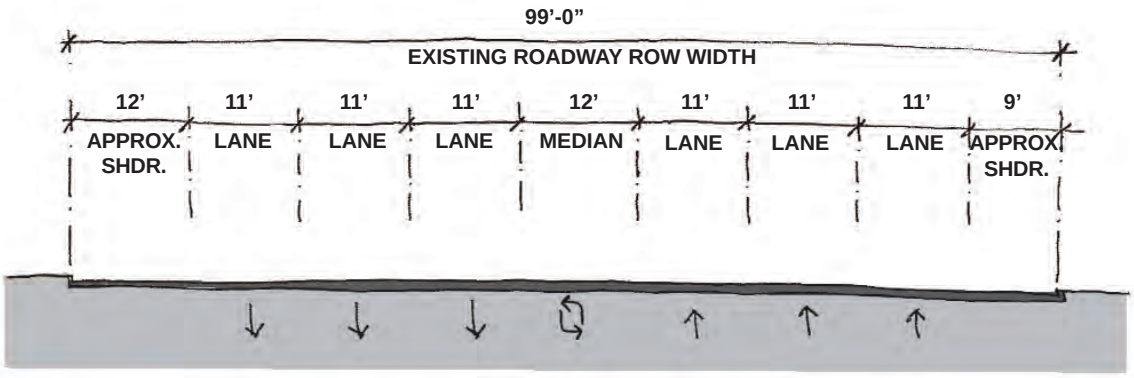


Figure 4-25. Existing SR 99 Typical Cross-section

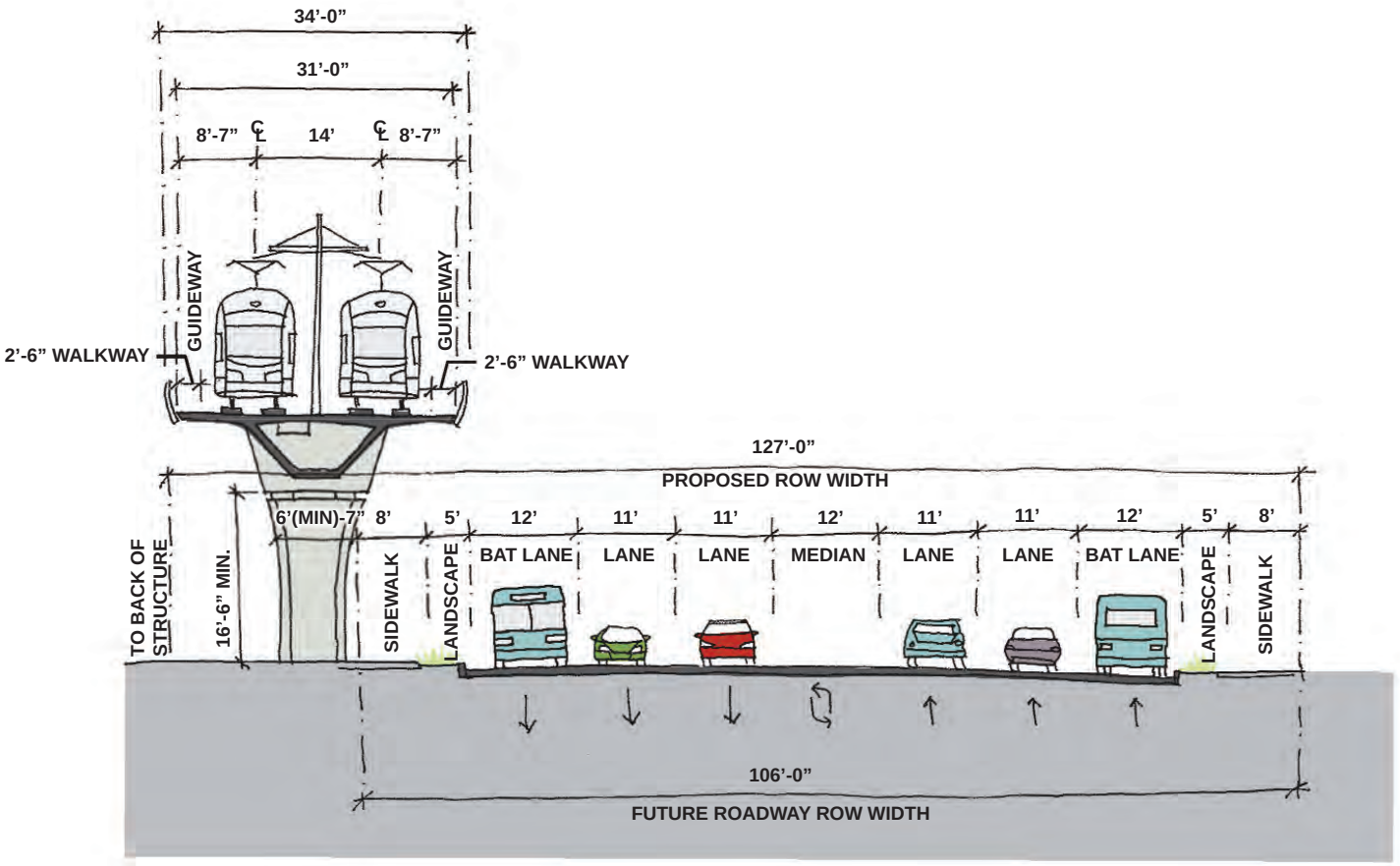


Figure 4-26. L3: SR 99 Elevated Light Rail Alternative Typical Cross-section

NORTHGATE TRANSIT CENTER TO NORTH 130TH STREET

The alignment would begin at the north end of the planned Link station tail tracks at Northgate Mall between 1st Avenue NE and the existing Northgate Transit Center. This alternative would have the same alignment as the L2: SR 99 Mixed Profile Light Rail Alternative between Northgate and approximately North 120th Street. The aerial alignment would continue north out of the station and then turn west, crossing over I-5, and continue along the south side of Northgate Way as an aerial guideway. An additional 15 to 20 feet of right-of-way would be required along Northgate Way.

As Northgate Way turns southwest, the alignment would continue west generally along the North 110th Street alignment. A section of this alignment may be at-grade, but most of it would be aerial. North 110th Street would be reconstructed to reconnect the local streets through this segment.

Near SR 99, the aerial alignment would curve to the south and then north to cross the northbound lanes and enter the median of SR 99. This long curve would require acquisition of new right-of-way to the south of North 110th Street in order to avoid affecting the adjacent cemetery. The aerial alignment would continue north in the median of SR 99 with a design that minimizes right-of-way impacts on the cemetery. At approximately North 120th Street, the alignment would cross over to the west side of SR 99 where 15 to 20 feet of additional right-of-way may be required for the elevated guideway. The aerial alignment would continue north along the west side of SR 99 to an aerial station located on the north side of North 130th Street. The station would feature a center platform and a ground-level plaza, requiring at least 60 feet of additional right-of-way.

NORTH 130TH STREET TO NORTH 160TH STREET

Continuing north of the 130th Street Station, the aerial alignment would continue along the west side of SR 99 to an aerial station located at North 160th Street. The station would feature a center platform and a ground-level plaza. The alignment would require modifications to the Interurban Trail where the pedestrian bridges cross North 155th Street and SR 99. Fifteen to 20 feet of additional right-of-way may be required for the elevated guideway and at least 60 feet required at the station location.

NORTH 160TH STREET TO SHORELINE PARK-AND-RIDE

North of the 160th Street Station, the alignment would continue on the west side of SR 99 in an aerial alignment to an elevated station at the Shoreline Park-and-Ride (North 192nd Street). The alignment matches back with the L2: SR 99 Mixed Profile Light Rail Alternative alignment at approximately North 175th Street. North of this point both alignments are the same. Fifteen to 20 feet of additional right-of-way may be required for the elevated guideway. The station would be located within the existing park-and-ride facility.

An elevated center platform station with a mezzanine would be located at the Shoreline Park-and-Ride. The station would have the following characteristics:

- Elevated pedestrian walkway between the existing Shoreline Park-and-Ride and the light rail station
- Sixteen bays for in-service and layover operations to replace the existing Aurora Village Transit Center
- A parking garage to replace the existing 600 parking spaces at the Shoreline Park and Ride (approximately 400 spaces) and the Aurora Village Transit Center (approximately 200 spaces), plus an additional 500 parking spaces for a total of 1,100 parking spaces

SHORELINE PARK-AND-RIDE TO MOUNTLAKE TERRACE TRANSIT CENTER

North of the Shoreline Park-and-Ride Station, the elevated alignment would continue along the west side of SR 99. Near the King/Snohomish County line, the aerial structure would turn east, crossing over SR 99 and the parking lots and commercial properties near the intersection of SR 99 and North 205th Street. The alignment would continue eastward along the south side of SR 104, crossing over Meridian Avenue, 1st Avenue NE, 5th Avenue NE, then across SR 104, and I-5. This route would cross over to the east side of I-5 and curve north toward the east side of the existing Mountlake Terrace parking garage.

The assumed station at Mountlake Terrace would be the same as the one defined for the L1: I-5 Light Rail Alternative. An aerial station would be located over 236th Street SW, with station entrances on the south and north sides of 236th Street SW, and would serve the Mountlake Terrace Transit Center, park-and-ride garage, and freeway station. The aerial station is assumed to be center platform with a ground-level plaza.

The Mountlake Terrace Station also would have the following characteristics:

- Two off-street in-service bus bays and six off-street layover bus bays at Mountlake Terrace Transit Center
- A new parking garage with approximately 230 parking spaces to replace existing surface parking that would be displaced by the expanded and relocated off-street bus layover bays

MOUNTLAKE TERRACE TRANSIT CENTER TO LYNNWOOD TRANSIT CENTER

The alignment in this segment is identical to that described in Section 4.3.1 for the L1: I-5 Light Rail Alternative.

4.5.2 Service Plan

Light rail service includes four-car trains serving stations at the Northgate Transit Center, North 130th Street, North 160th Street, Shoreline Park-and-Ride, Mountlake Terrace Transit

Center, and the Lynnwood Transit Center. Service would be provided 20 hours per day, with peak headways of 4 minutes and off-peak headways of 10 minutes.

Community Transit routes that now serve the Aurora Village Transit Center would be extended south on SR 99 to serve the new Shoreline Transit Center and light rail station. Similarly, King County Metro routes that now serve the Aurora Transit Center would be truncated at the new Shoreline Transit Center and light rail station.

Local King County Metro routes in north King County would be adjusted to serve light rail. Existing routes would either be truncated or extended to serve the new light rail stations at North 130th Street, North 160th Street, Shoreline Park-and-Ride, and the Mountlake Terrace Transit Center.

Most Sound Transit and Community Transit routes from south Snohomish County that operate to Seattle would terminate in Lynnwood where passengers would transfer to light rail. The exceptions are routes that currently originate in Edmonds and provide service to downtown Seattle and the University District. These routes would terminate at the Mountlake Terrace and Shoreline Park-and-Ride Stations where passengers would transfer to light rail. North Snohomish County commuter routes would continue to operate unchanged from today's operations. King County Metro Route 301 would be discontinued and Route 304 would be truncated at the North 160th Street Station.

King County Metro RapidRide E Line BRT would interface with Community Transit's *Swift* BRT service at the Shoreline Park-and-Ride Station, which would be the terminus for both BRT services.

4.6 B2: MULTI-CORRIDOR BUS RAPID TRANSIT ALTERNATIVE

The B2: Multi-Corridor BRT Alternative consists of three BRT lines serving each of the major north-south roadways between the existing Northgate and Lynnwood Transit Centers. Direct access ramps to and from the north would provide direct connections for transit between the Northgate Transit Center and the I-5 HOV lanes. Additionally, direct access ramps to and from the south connecting into the I-5 HOV lanes would be provided at NE 130th Street for transit and HOVs. As with the TSM/Baseline Alternative, existing bus services in the project area focused on the University District and downtown Seattle would remain in place. The three proposed routes comprising this alternative are shown in Figure 4-27 and would run along SR 99, I-5, and 15th Avenue NE. BRT vehicles and supporting maintenance facility capacity would be included. Physical improvements to facilitate the BRT service would include the following:

Transit Signal Priority: Transit signal priority improvements would be required at all signals along 15th Avenue NE, 200th Street SW, and North 130th Street. Also, because the existing transit signal priority systems on SR 99 in King and Snohomish counties use different technologies, BRT vehicles would be equipped with both types of technology in order to use them.

Stations: The BRT service would use existing Community Transit *Swift* and King County Metro RapidRide stations along SR 99 and the existing Lynnwood Transit Center and Mountlake Terrace Freeway Station. Five new BRT stations would be required. Four of these stations are in the 15th Avenue NE corridor, with one in the SR 99 corridor, as follows:

- Ballinger Way NE/19th Avenue NE
- NE 175th Street/15th Avenue NE
- NE 145th Street/15th Avenue NE
- NE 125th Street/15th Avenue NE
- SR 99/North 160th Street

Rider Amenities: Real-time operating information, closed-circuit television, and off-board fare collection would be incorporated at BRT stations.

4.6.1 Facility Design

The proposed I-5 BRT route would use the existing HOV direct access ramps at Lynnwood, the HOV lanes on I-5, and the Mountlake Terrace Freeway Station. New HOV direct access ramps would be constructed to and from the south at North 130th and new transit-only ramps to and from the north at Northgate Transit Center to serve all three BRT routes. The Northgate ramps would connect directly into the transit center adjacent to the Link light rail station. The existing HOV lanes would be used with no modifications except at as needed for the new direct access ramps. The existing configuration of I-5 has very little to no median space between Northgate and North 130th Street. In addition, most of the HOV lanes along this segment of I-5 do not have shoulders that meet current WSDOT standards. Any modifications to the HOV lanes and ramps to the HOV lanes would require widening of I-5 to accommodate the proposed ramps and possibly standard shoulder widths.

The layout of the BRT system includes the following assumptions:

- The Northgate direct access ramp would be bus only; HOVs would be prohibited since the only access would be to the transit center, where private vehicles are prohibited.
- The North 130th Street direct access ramp would accommodate transit and HOVs. WSDOT has indicated that with the potential future development of managed lanes in this section of I-5, a new access here would need to provide for HOV and possibly toll paying vehicles as well as buses.
- Transit-only ramps would be approximately 35 feet wide, providing two-way bus operations with no median barrier. HOV ramps would be designed to meet full interstate freeway standards.
- I-5 would be widened to WSDOT standards within the areas affected by the direct access ramps. This work could include repaving and upgrading drainage and utilities for the existing portions of those sections of freeway.

Figure 4-27. B2: Level 2 Multi-Corridor BRT Alternative

NORTHGATE STATION

Northgate would be the southern terminus of the three new BRT lines where riders transfer to the light rail system. The existing transit center would be reconstructed as a two-level station—the bottom level serving local buses and the top level serving the BRT vehicles. Center passenger platforms would be built with stairs and elevators connecting the two levels. A pedestrian connection between the bus station and the light rail station would accommodate transfers between the two systems. This preliminary concept may evolve with more detailed design work.

Bus bay and layover requirements at the Northgate Transit Center include the following:

- The I-5 BRT service would require one bay for drop-off and one bay for pick-up, sized for articulated buses, and layover space for at least three articulated buses. Route 510/513 would require one in-service bay and one layover bay designed for articulated buses. The total bay requirements for the package of changes associated with the I-5 BRT service are three in-service bays and four layover bays.
- The 15th Avenue NE BRT service would require one bay for drop-off and one bay for pick-up for one articulated bus, and layover space for up to two articulated buses.
- The SR 99 BRT service would require one bay for drop-off and one bay for pick-up for one articulated bus, and layover space for up to two articulated buses.
- The total new bay requirements at Northgate Transit Center are seven in-service bays and eight layover bays. These would be located in the new second level of the Northgate Transit Center.

Bus-only direct access ramps to and from the north would connect the HOV lanes to the top level of the transit center as shown in Figure 4-28. These ramps would connect into the median of I-5 north of the express lanes terminus and have an S-curve layout between I-5 and the transit center. A 30-mph design speed is proposed. The ramps would pass over I-5, 1st Avenue NE, and NE 103rd Street, and pass under the light rail station tail tracks. The facility would connect to the local arterial street network to provide access for buses via a driveway and surface improvements adjacent to NE 103rd Street within the Northgate Mall parking lot.

To accommodate the bus ramps in the I-5 median, the southbound lanes of the freeway would be moved approximately 30 feet to the west and some reconstruction of the existing ramps would be required. This widening would extend approximately 0.3 mile to the north to accommodate the vertical profile of the ramps and the acceleration and deceleration lengths required for connections into the HOV lanes. Additional widening of northbound I-5 would be required, including the widening of the structure over Northgate Way, to provide the merge gap acceptance length required by WSDOT standards. This widening cannot be provided within the current median space. The northbound mainline must be widened to the east, which would affect the on-ramps from the Northgate Mall and NE Northgate Way. The widening associated with these ramps then would affect the frontage road and 117th Street flyover bridge. The total length of I-5 modifications would be approximately 0.9 mile and would extend

to meet the mainline widening that would be required to accommodate the proposed BRT improvements for the 130th Street direct access ramp. The proposed BRT station and ramps are shown in Figure 4-28. Additional right-of-way beyond the existing I-5 right-of-way would be required for some portions of this improvement.

NE 130TH STREET

Direct access HOV ramps from the I-5 median HOV lanes to and from the south would rise to the grade of NE 130th Street where a new intersection would be created. I-5 would require widening for approximately 0.6 mile to the south and 0.5 mile to the north. The NE 130th Street Bridge would require reconstruction to allow the widened I-5 cross-section to pass under the structure and to provide the intersection improvements proposed. The proposed direct access ramp is shown in Figure 4-29.

SHORELINE PARK-AND-RIDE

The B2: Multi-Corridor BRT Alternative assumes that the transit terminus functionality of the Aurora Village Transit Center would be re-located to the Shoreline Park-and-Ride, along with the existing 200-space park-and-ride capacity of the Aurora Village Transit Center. An additional 500 stalls of parking capacity would be provided, for a total of 1,100 park-and-ride stalls. The re-located transit center would consist of nine in-service bays and seven layover bays.

MOUNTLAKE TERRACE TRANSIT CENTER (236TH STREET SW)

The I-5 BRT line would use the existing Mountlake Terrace Freeway Station. No additional improvements are anticipated at this location. This station is an at-grade median transit stop with stairs, elevators, and a pedestrian bridge connecting the station to the existing park-and-ride garage. No additional terminating routes are expected at the Mountlake Terrace Transit Center; thus, no additional layover spaces or bus bays would be required as a result of this alternative.

LYNNWOOD TRANSIT CENTER

This location would use the existing HOV direct access ramps. These ramps connect both north and south along I-5 to the Lynnwood Transit Center. Similar to the light rail alternatives, 500 new structured park-and-ride stalls are assumed at the Lynnwood Transit Center bringing the total to 1,900 spaces. Three additional layover bays would be required at the Lynnwood Transit Center to accommodate the proposed BRT services.

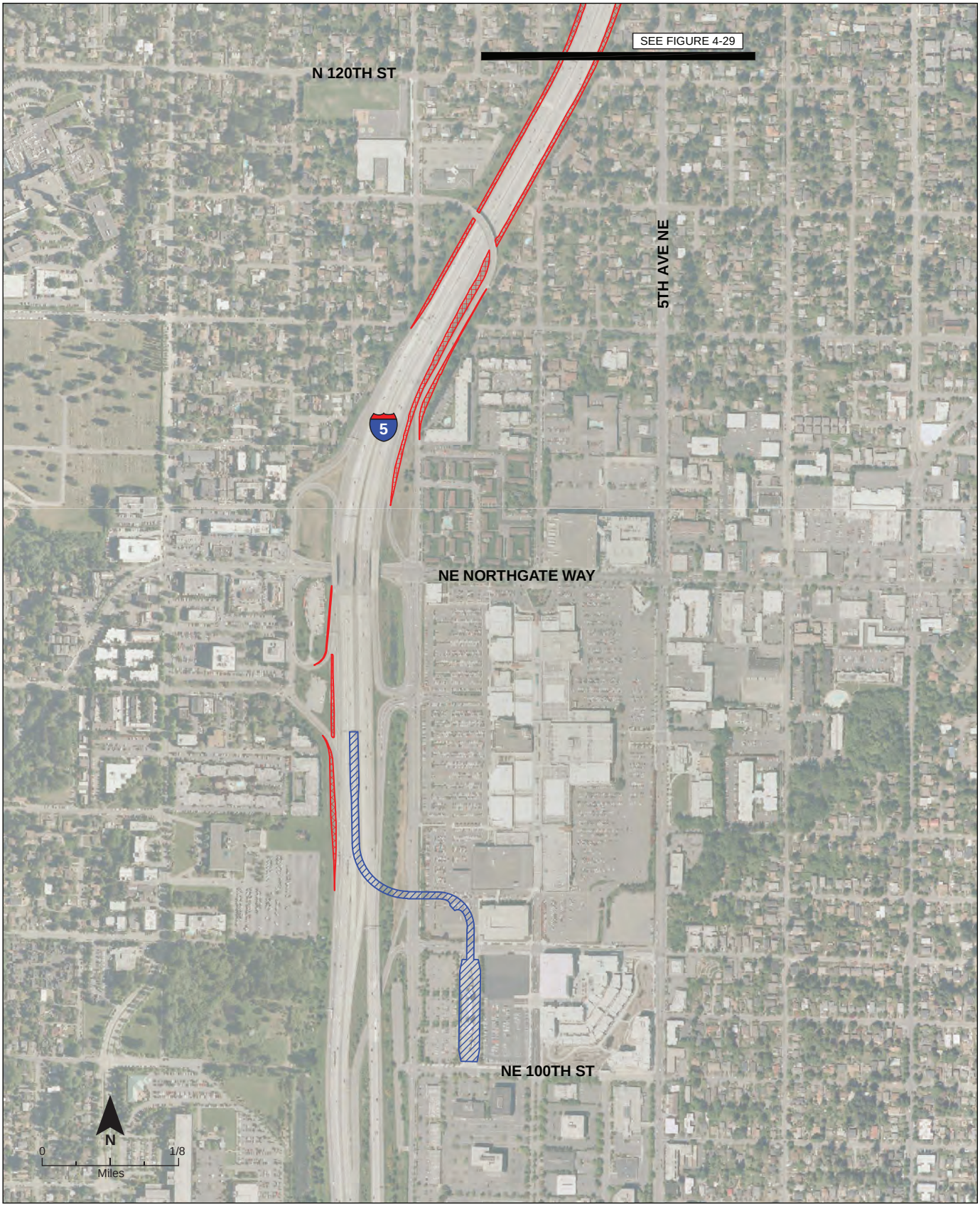


Figure 4-28. Direct Access Improvements and Northgate BRT Station - 1 of 2

Figure 4-29. Direct Access Improvements and Northgate BRT Station - 2 of 2

4.6.2 Service Plan

Service for this alternative consists of three new high-frequency bus routes serving the North Corridor area between the Lynnwood Transit Center and the Northgate Transit Center where service would tie into Link light rail. Specific operating details of these three BRT routes are as follows:

- **SR 99 Route:** Lynnwood Transit Center, 200th Street SW, SR 99/Aurora Avenue North, NE 130th Street, NE 130th Street direct access ramp, I-5, Northgate direct access ramp, Northgate Link Station
- **15th Avenue NE Route:** Mountlake Terrace Transit Center, 236th Street SW, 56th Avenue West/19th Avenue NE, NE 196th Street, 15th Avenue NE, NE 125th Street, Roosevelt Way, NE 130th Street, NE 130th Street direct access ramp, I-5, Northgate direct access ramp, Northgate Link Station
- **I-5 BRT Route:** Lynnwood Transit Center, I-5, Mountlake Terrace Freeway Station, I-5, Northgate Link Station

BRT service on all three routes would be provided from 4:30 am to 1:30 am on Monday to Saturday and from 5:30 am to 1:00 am on Sunday. (The actual schedule would be timed for first southbound and last northbound trains at Northgate.)

Service frequencies were developed and refined to meet the projected ridership demand. On the SR 99 BRT route, frequencies would be every 10 minutes during peak periods and every 15 minutes during off-peak periods. On the I-5 BRT route, frequencies would be every 2 minutes during peak periods and every 10 minutes during off-peak periods. The 15th Avenue NE BRT route frequency would be every 15 minutes during both peak and off-peak periods.

Sound Transit Express and Community Transit commuter and local bus routes would not change, other than a minor re-route of Route 112 to serve the Mountlake Terrace Transit Center. King County Metro Routes 301 and 303 would be replaced by the new SR 99 to Northgate Express route. Community Transit routes that now serve the Aurora Village Transit Center would be extended south on SR 99 to serve the new Shoreline Transit Center. Similarly, King County Metro routes that now serve the Aurora Transit Center would be truncated at the new Shoreline Transit Center. Existing arterial BRT services would not be affected, but would rather be complemented by the new service.

4.7 OPERATION AND MAINTENANCE FACILITIES

All of the build alternatives require vehicle fleet expansions and associated additional operations & maintenance (O&M) base capacity to support them. The ST 2 finance plan includes funds for additional rail and bus O&M facilities to support the expanded system. While the new O&M capacity was determined in the plan and will be developed at the systems level, costs for these additions have been allocated to each corridor expansion on a per vehicle basis. Thus, the costs for O&M facility expansion are included in the estimates for all North Corridor build alternatives. The system-level process of identifying and analyzing alternatives for O&M facility expansion was recently initiated by Sound Transit through a separate effort designed to develop base capacity sufficient to support all corridor needs.

5 ANALYSIS OF ALTERNATIVES

The Level 2 alternatives were evaluated based on criteria and performance measures derived from the project's purpose and need as described by the methodology documented in Chapter 3. Criteria to measure how well the alternatives address the North Corridor Transit Project's purpose and need fall into six broad categories:

- Transportation effectiveness in meeting mobility, access, and capacity needs
- Supportive land use and economic development effects
- Preservation of a healthy environment
- Equitable community impacts and benefits
- Cost and constructability
- Consistency with Sound Transit's Long-Range Plan vision

This chapter discusses the detailed findings of the evaluation of the Level 2 alternatives organized by the evaluation criteria. Key findings are provided at the beginning of each subsection to help distinguish between the alternatives and/or provide added insight into the performance of specific alternatives. Chapter 7 contains a comparative summary analysis of the Level 2 evaluation findings organized by the six broad categories. Chapter 8 presents the next steps and recommendations for the development of alternatives to be carried forward into an EIS.

5.1 TRANSPORTATION EFFECTIVENESS

This section summarizes the evaluation results for the transportation effectiveness measures as applied to each of the alternatives. Sound Transit's Regional Forecasting Model was applied to generate 2030 forecasts of transit ridership for the No Build Alternative, TSM/Baseline Alternative, and each of the build alternatives (Sound Transit 2010f, 2010g).

Model results were used to compare each alternative's effectiveness with regard to ridership potential, ability to accommodate demand, travel time changes, and system-wide vehicle miles traveled. Qualitative assessments of transit reliability and transit service accessibility were also included in this evaluation. Key findings and results for each of the evaluated transportation effectiveness measures are described in this section.

5.1.1 Key Findings

Key findings for each of the transportation effectiveness measure categories are summarized in the following section.

RIDERSHIP POTENTIAL

2030 System-Wide and Project Daily Riders

Both year 2030 total system-wide and daily project ridership forecasts are highest for the L1: I-5 Light Rail Alternative, followed by the L3: SR 99 Elevated Light Rail Alternative. Ridership for the L2: SR 99 Mixed Profile Light Rail Alternative would be lower than for L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative, but would be significantly higher than the TSM/Baseline or B2: Multi-Corridor BRT Alternatives. Similar results are seen for year 2030 annual new riders and user benefits in comparison to the No Build Alternative.

One reason that the L2: SR 99 Mixed Profile Light Rail, B2: Multi-Corridor BRT, and TSM/Baseline Alternatives are projected to have substantially fewer new riders than the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives is that the travel time savings would be less. Another key reason is that competitive transit options exist for these alternatives. Because of longer travel times, less frequent service, and lower capacity for the TSM/Baseline, L2: SR 99 Mixed Profile Light Rail and B2: Multi-Corridor BRT Alternatives, I-5 express bus routes serving the University of Washington and downtown Seattle would be maintained in those alternatives. For the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives, many of these routes are truncated at the Lynnwood, Mountlake Terrace, or 185th Street stations.

Transit Trips to Regional Growth Centers

The L1: I-5 Light Rail Alternative would result in the highest increase over No Build in the number of estimated year 2030 daily transit trips made to all four regional growth centers, at more than 10,000 trips. The L3: SR 99 Elevated Light Rail Alternative would result in approximately 20 percent fewer total trips to the selected growth centers compared to the L1: I-5 Light Rail Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative would result in more than double the increase in transit trips to the selected regional growth centers of the B2: Multi-Corridor BRT Alternative, and more than three times the increase of the TSM/Baseline Alternative, but less than the L1: I-5 Light Rail Alternative.

ABILITY TO ACCOMMODATE DEMAND

Person-Carrying Capacity Per Hour

The L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail alternatives would provide the highest peak period carrying capacity among the alternatives. The L2: SR 99 Mixed Profile Light Rail Alternative would provide approximately half the capacity of the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives due to its 8-minute peak headways (the time between successive train movements in a given direction) as compared to 4 minutes for the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives. The two bus based alternatives provide substantially less carrying capacity than any of the light rail alternatives.

Peak-Hour Ridership Demand/Operating Capacity Per Hour

The L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative would accommodate forecasted ridership demand through 2030 and would provide additional capacity for future growth in demand and future extension of the line to Everett. The L2: SR 99 Mixed Profile Light Rail Alternative would also accommodate forecasted ridership demand through 2030, but would provide very little capacity for future growth in demand or extension to Everett. In addition, if I-5 bus service were truncated at any of the rail stations under the L2: SR 99 Mixed Profile Light Rail Alternative, ridership demand would likely exceed the operating capacity of the alternative. The TSM/Baseline Alternative is expected to be at capacity by the year 2030, while the B2: Multi-Corridor BRT Alternative would be approaching capacity, particularly on the highest demand route connecting Lynnwood and Northgate via I-5.

TRAVEL TIME

2030 Transit Travel Time

For year 2030 peak period travel from Lynnwood and Shoreline to the regional rail system at Northgate, all of the alternatives are estimated to provide substantially shorter travel times compared to the No Build Alternative, with the shortest being the L1: I-5 Light Rail Alternative (14 minutes from Lynnwood, 7 minutes from Shoreline). Peak direction travel times from Lynnwood to Northgate for the L3: SR 99 Elevated Light Rail, the L2: SR 99 Mixed Profile Light Rail, and the B2: Multi-Corridor BRT Alternatives would be approximately 4, 7, and 10 minutes longer than for the L1: I-5 Light Rail Alternative, respectively.

2030 Travel Time Comparison—Transit vs. Automobile

Year 2030 automobile travel times from Lynnwood to Northgate are estimated to be slower than transit travel times for the TSM/Baseline and all the build alternatives (4 minutes slower than the TSM/Baseline Alternative, 10 minutes slower than the B2: Multi-Corridor BRT Alternative, and approximately 13 to 20 minutes slower than the light rail alternatives).

TRANSIT RELIABILITY

Substantial portions of the TSM/Baseline and B2: Multi-Corridor BRT Alternatives would use non exclusive guideway (both more than 20 miles), exposing transit service to traffic congestion, while the light rail alternatives would be on exclusive guideway for their entire length, making them more reliable.

The L1: I-5 Light Rail and the L3: Elevated Light Rail Alternatives would exhibit the best travel time reliability of all the alternatives due to the total length of each being in exclusive right of-way, traversing no signalized intersections, and requiring no transfers to reach multiple regional destinations via the regional transit system. The L2: SR 99 Mixed Profile Light Rail Alternative and the SR 99 North Variation would have slightly lower reliability due to potential delays crossing at-grade signalized intersections. The two bus-based alternatives would be much less reliable due to traveling in non-exclusive right-of-way, traversing a high number of congested intersections, and requiring a transfer to the overall regional rail system to reach other regional destinations.

System-wide Vehicle Miles Traveled

The reduction in overall system daily vehicle miles traveled (VMT) with the L1: I-5 Light Rail Alternative is projected to be more than twice the reduction that would result from the L2: SR 99 Mixed Profile Light Rail Alternative, and roughly 19 percent higher than the L3: SR 99 Elevated Light Rail Alternative. The VMT reduction with both the bus-based alternatives is expected to be substantially less than any of the light rail alternatives.

Transit Service Accessibility

The TSM/Baseline and B2: Multi-Corridor BRT Alternatives are estimated to have the highest level of accessibility to transit service in general because they each have almost twice as many points of access as the rail alternatives. However, despite the higher level of access, the projected ridership and user benefits of the two bus-based alternatives are considerably lower than any of the light rail alternatives, indicating that accessibility needs to be coupled with quality service to be effective in attracting riders.

The level of accessibility is similar between the light rail alternatives. For the L1: I-5 Light Rail Alternative, I-5 provides a barrier that limits accessibility. For the L2: SR 99 Mixed Profile Light Rail Alternative and L3: Elevated Light Rail Alternative, a combination of factors including an incomplete street grid, relatively long distances between blocks, and a prevalence of arterials without sidewalks surrounding SR 99 reduces the relative accessibility of these alternatives.

5.1.2 Ridership Potential

Ridership potential is evaluated based on the following four measures: 2030 project daily riders, 2030 annual new riders, 2030 user benefits – annual hours saved, and transit trips to selected regional growth centers. The measures are designed to distinguish the potential for transit ridership, including new riders generated in the North Corridor and new riders and user benefits

of the entire regional transit system due to the addition of the North Corridor alternative to the system. Detailed ridership forecasting methods and underlying assumptions can be found in the Transit Ridership Forecasting Technical Report (Sound Transit 2010e).

TRANSIT RIDERSHIP AND USER BENEFITS

All of the North Corridor Transit Project alternatives would increase system-wide ridership over the Sound Transit model 2030 No Build projection of 508,000 total daily transit trips. As shown in Figure 5-1, the light rail alternatives show the highest increase in total system transit use. The percentage increase in total system daily transit trips with the L1: I-5 Light Rail Alternative as compared to No Build is nearly four times that forecasted for the B2: Multi Corridor BRT Alternative and over seven times that of the TSM/Baseline Alternative.

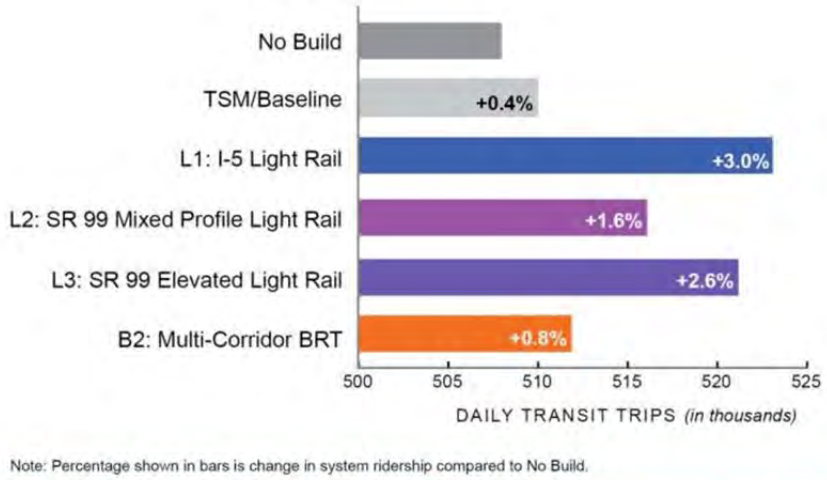


Figure 5-1. 2030 Total System Daily Transit Trips and Percent Change for Alternatives Compared to No Build

A comparison of 2030 user benefits was also made using model output for annual hours of travel time saved system-wide. User benefits are measured based on an economic theorem of consumer surplus that also has been used in the FTA Summit program for estimating user benefits[1]. Similar results, illustrated in Table 5-1, are seen for project daily riders, annual new riders, and user benefits, with the L1: I-5 Light Rail Alternative showing more than double the daily ridership and more than four times the annual new riders and user benefits of the B2: Multi Corridor BRT Alternative. The L3: SR 99 Elevated Light Rail Alternative results in 600,000 fewer annual new riders and 800,000 fewer annual hours saved than the L1: I-5 Light Rail Alternative,

[1] The Summit software program was developed by FTA for preparation of information for evaluation of New Starts applications. The key output from the Summit program is user benefits, which is based on the concept of consumer surplus. People will travel to a destination using their selected mode when the overall cost of travel is less than or equal to the benefit of travel, where the benefit is essentially the maximum cost that they would be willing to incur for that travel. When the cost is less than this "willingness to pay," the difference between the two is referred to as the "consumer surplus." It represents the benefit of travel above and beyond the required cost.

while the L2: SR 99 Mixed Profile Light Rail Alternative shows 2 million fewer annual new riders and 2 million fewer annual hours saved than the L1: I-5 Light Rail Alternative.

Table 5-1. Transit Ridership Forecasting Model Output Summary for 2030

Alternative	Project Daily Riders	Annual New Riders*	User Benefits – Annual Hours Saved*
TSM/Baseline	21,000	0.64 million	0.59 million
L1: I-5 Light Rail	52,000	4.5 million	4.6 million
L2: SR 99 Mixed Profile Light Rail**	41,000	2.5 million	2.4 million
SR 99 North Variation	39,000	2.3 million	2.1 million
L3: SR 99 Elevated Light Rail	48,000	3.9 million	3.8 million
B2: Multi-Corridor BRT	24,000	1.1 million	1 million

*Compared to the No Build Alternative

**The Roosevelt Way Variation was not modeled, but is expected to result in slightly lower values than the L2: SR 99 Mixed Profile Light Rail Alternative for all ridership figures in this table, because it does not include a station at North 130th Street and SR 99.

Year 2030 daily transit ridership by segment is illustrated in Figures 5-2 through 5-7. Similar to other ridership-related measures, the L1: I-5 Light Rail Alternative would have the highest ridership, at more than twice the ridership of the TSM/Baseline and B2: Multi-Corridor BRT Alternatives on the segment north of Northgate. Daily ridership for the L3: SR 99 Elevated Light Rail Alternative would be less than for the L1: I-5 Light Rail Alternative, with approximately 8 percent lower ridership on the highest ridership segment just north of Northgate, and approximately 18 percent higher than the L2: SR 99 Mixed Profile Light Rail Alternative. Daily ridership for the B2: Multi-Corridor BRT Alternative is projected to be higher than the TSM/Baseline Alternative by about 13 percent on the segment north of Northgate. Of the three routes comprising the B2: Multi-Corridor BRT Alternative, the I-5 route would have by far the highest ridership, with the 15th Avenue and SR 99 routes carrying only a small fraction of the overall riders for the alternative.

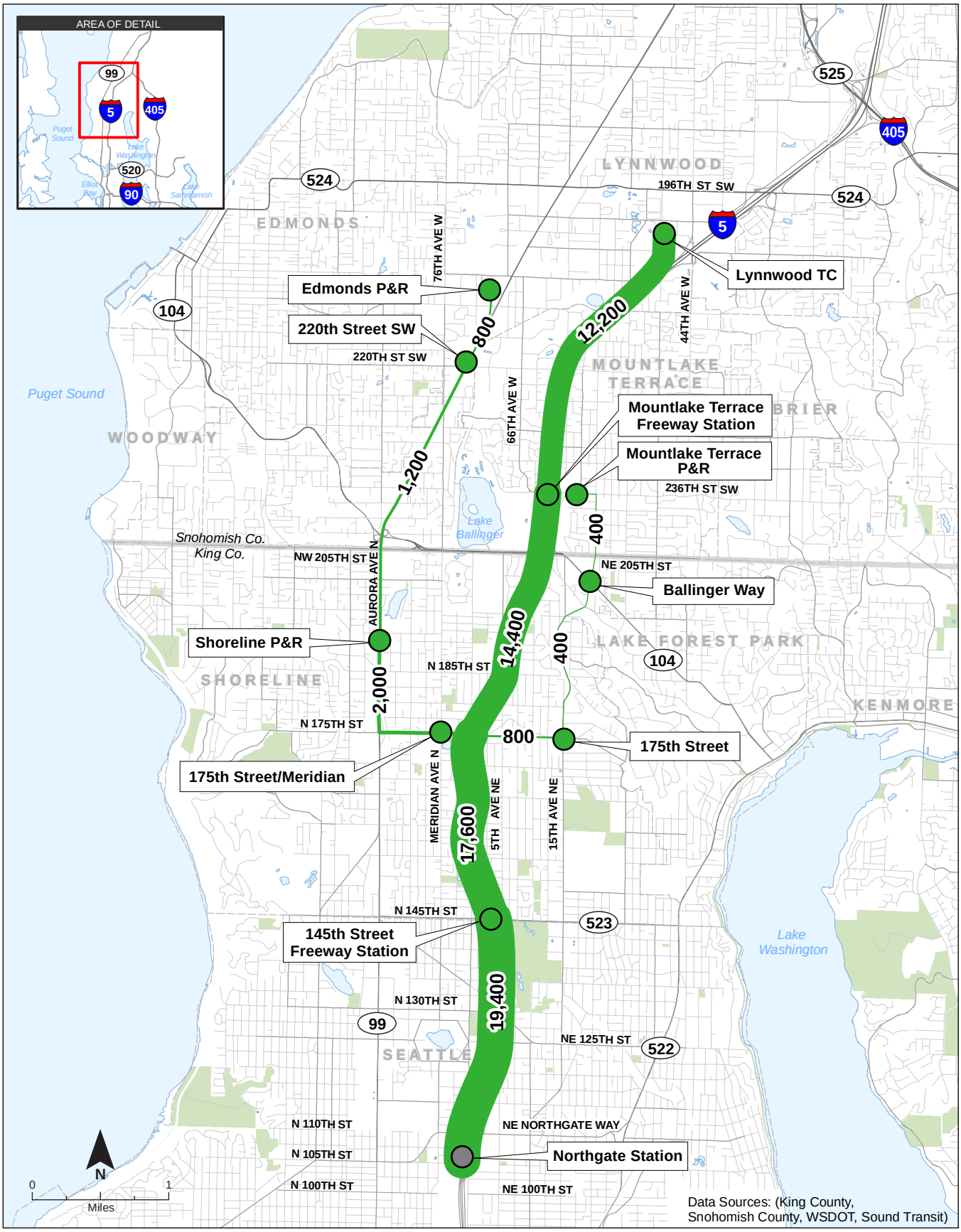
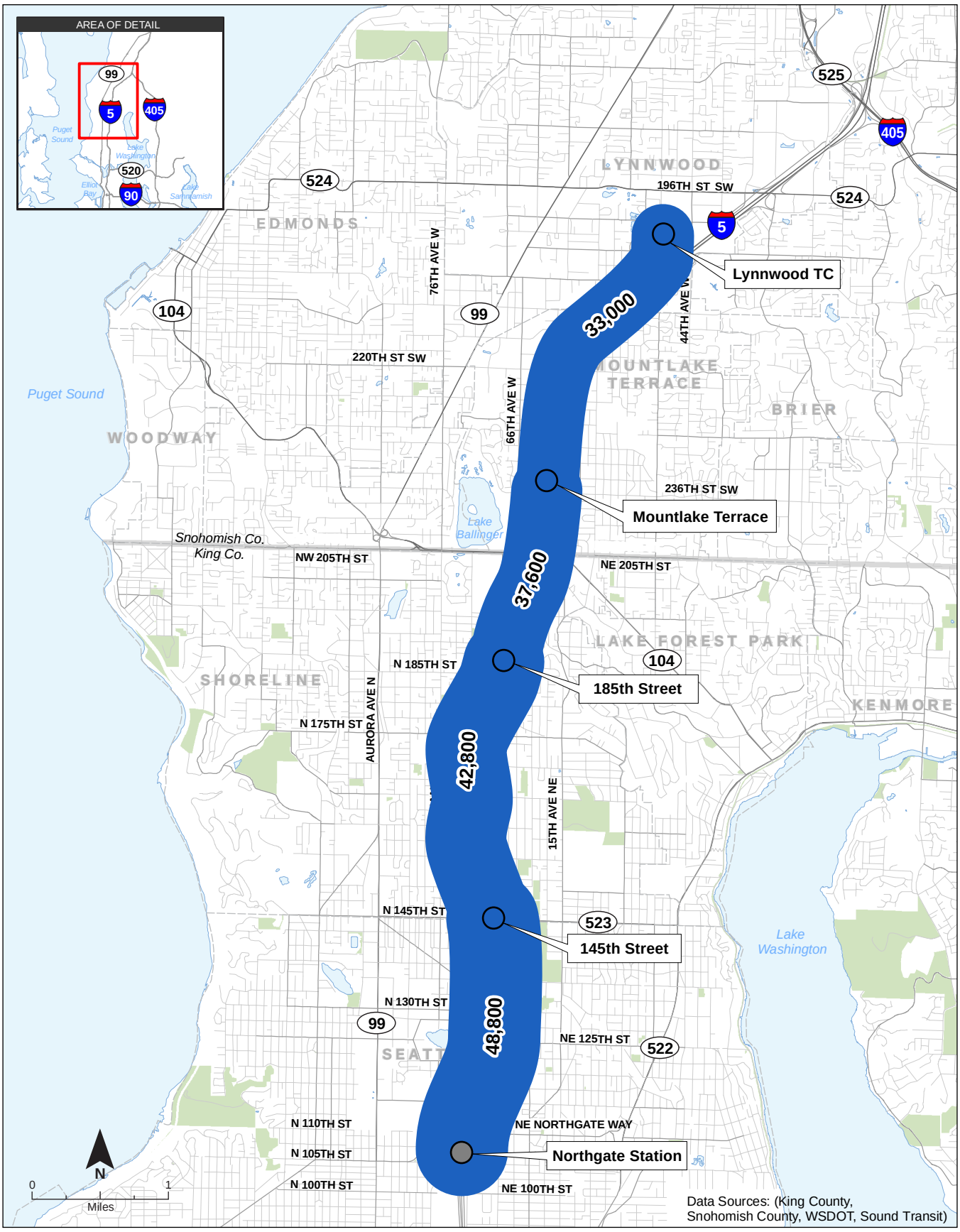


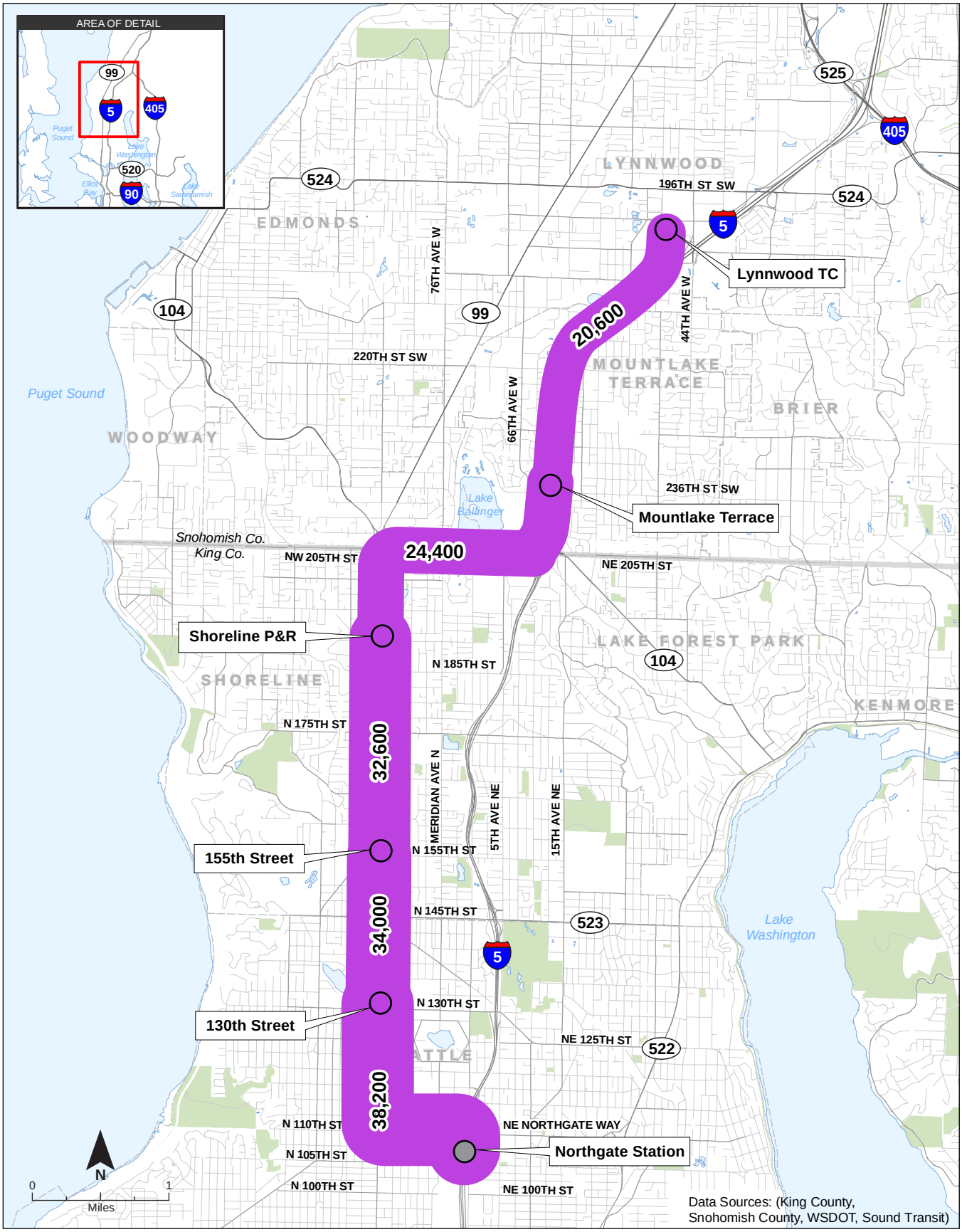
Figure 5-2. 2030 Daily Transit Ridership - TSM/Baseline



2030 Daily Transit Ridership

Note: Transit ridership shown reflects only ridership on the proposed light rail service.

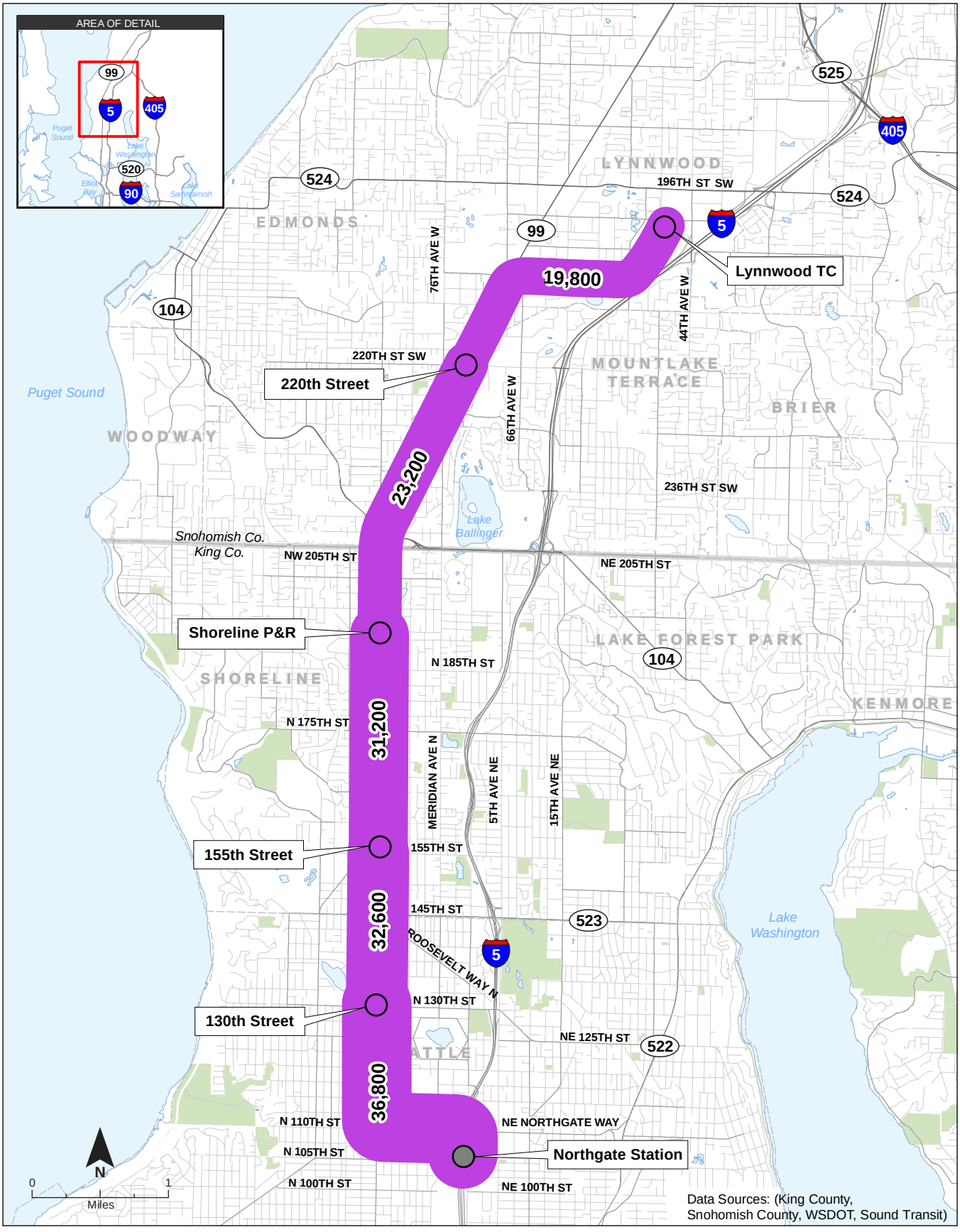
Figure 5-3. 2030 Daily Transit Ridership - L1: I-5 Light Rail



2030 Daily Transit Ridership

Note: Transit ridership shown reflects only ridership on the proposed light rail service.

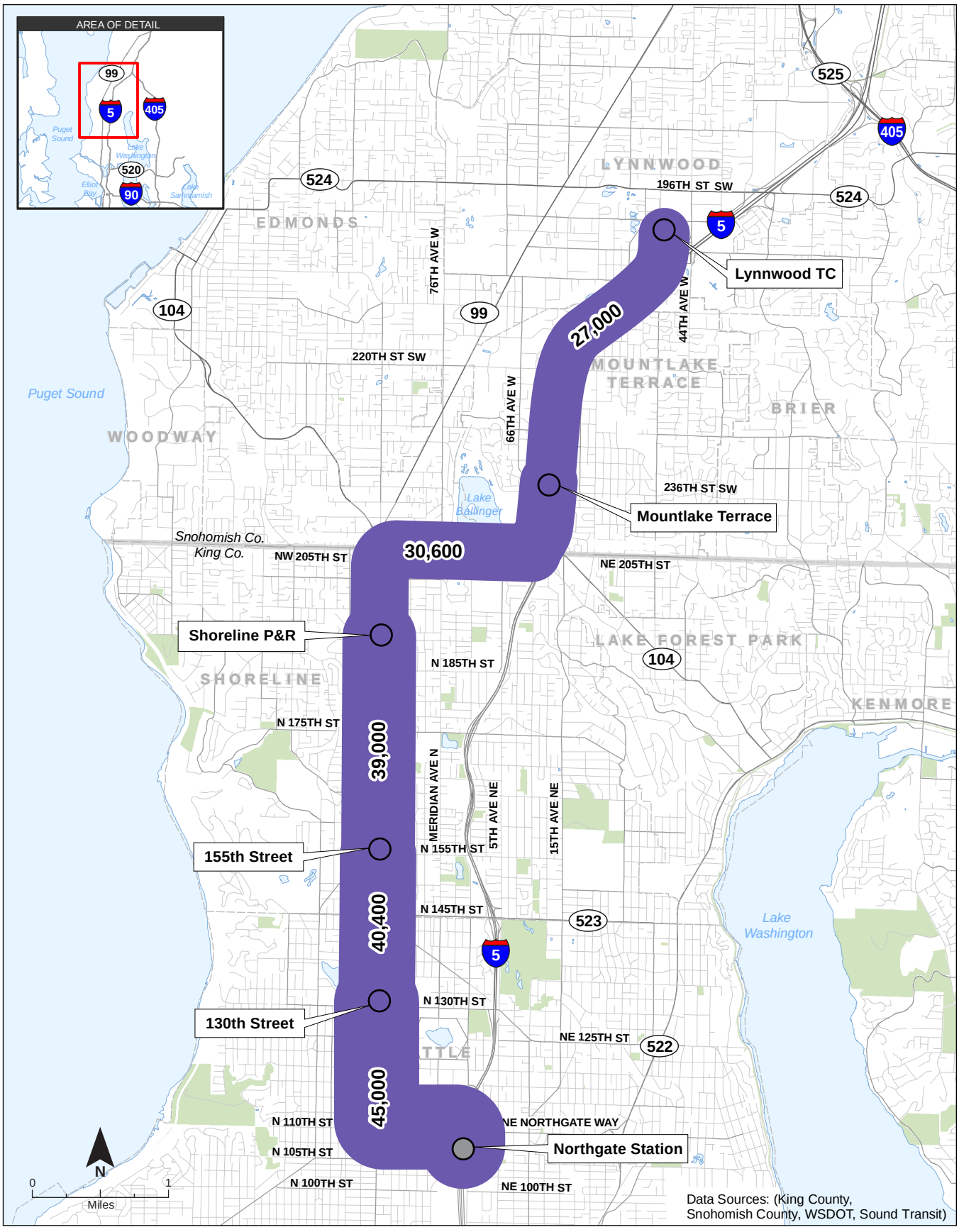
Figure 5-4. 2030 Daily Transit Ridership - L2: SR 99 Mixed Profile Light Rail



2030 Daily Transit Ridership

Note: Transit ridership shown reflects only ridership on the proposed light rail service.

Figure 5-5. 2030 Daily Transit Ridership - L2: SR 99 North Variation



2030 Daily Transit Ridership

Note: Transit ridership shown reflects only ridership on the proposed light rail service.

Figure 5-6. 2030 Daily Transit Ridership - L3: SR 99 Elevated Light Rail

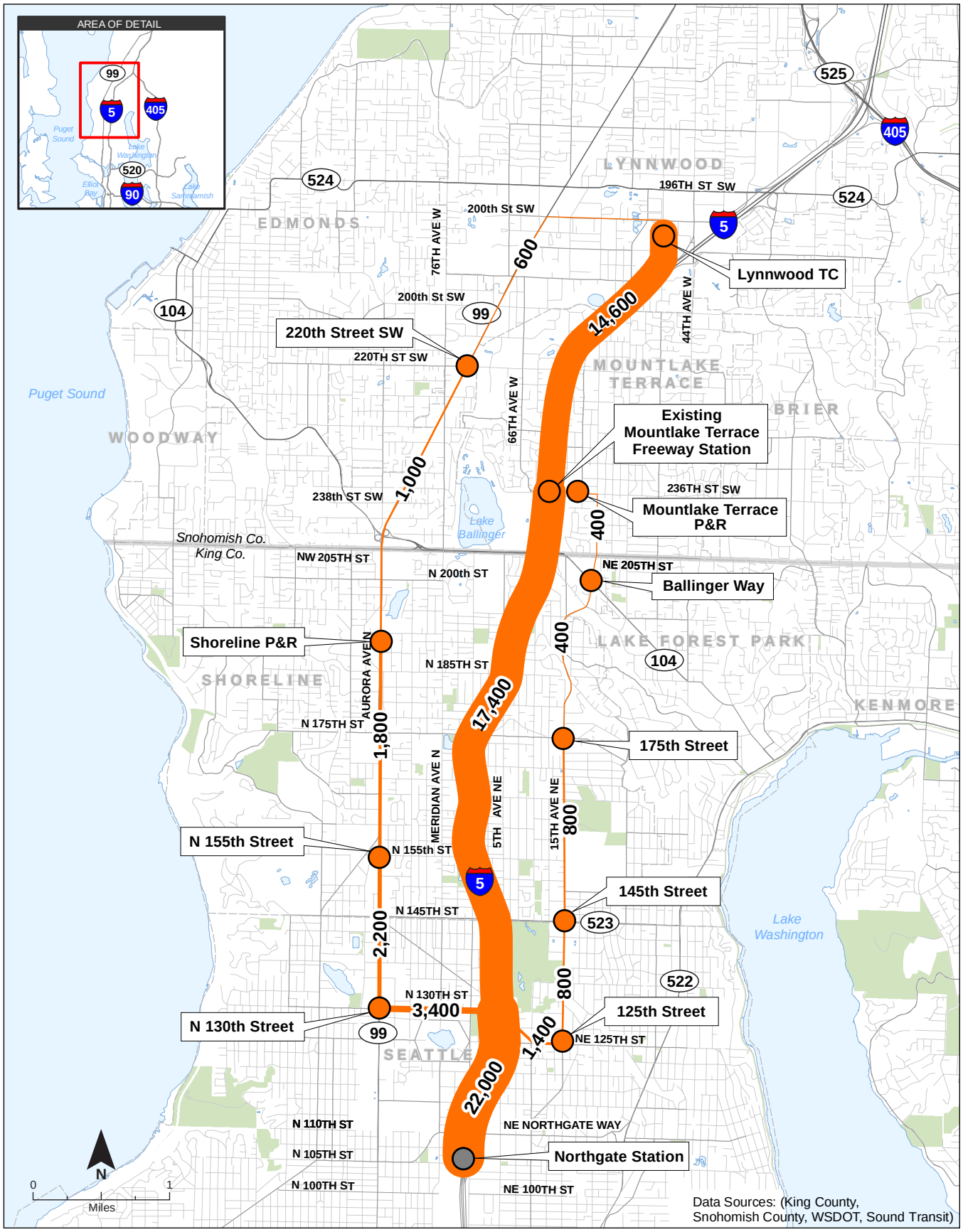


Figure 5-7. 2030 Daily Transit Ridership - B2: Multi-Corridor BRT

TRIPS TO SELECTED REGIONAL GROWTH CENTERS

This measure provides an indicator of how well each alternative connects selected regional destinations via transit by looking at total daily transit trips made to each of the following four PSRC-designated Regional Growth Centers within the North Corridor transit market: Lynnwood, Northgate, University District, and downtown Seattle. (More information on regional growth centers can be found in Section 5.2.)

Table 5-2 provides the changes in daily transit trips to and from the selected regional growth centers.

The L1: I-5 Light Rail Alternative would result in the highest increase in the number of daily transit trips made to all four selected regional growth centers combined, at more than 10,000 trips. The L3: SR 99 Elevated Light Rail Alternative would result in approximately 20 percent fewer total trips to the selected growth centers compared to the L1: I-5 Light Rail Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative would result in more than 30 percent fewer trips than the L3: SR 99 Elevated Light Rail Alternative, but more than double the increase in transit trips to the selected regional growth centers of the B2: Multi Corridor BRT Alternative, and more than three times the increase of the TSM/Baseline Alternative. The regional growth center with the highest increase in transit trips is downtown Seattle, with approximately 3,700 more transit trips for the L1: I-5 Light Rail Alternative.

Table 5-2. 2030 Change in Daily Transit Trips to/from Selected Regional Growth Centers

Alternative	Lynnwood	Northgate	University District	Seattle CBD	Total
TSM/Baseline	500	500	200	300	1,500
L1: I-5 Light Rail	2,300	1,300	3,100	3,700	10,400
L2: SR 99 Mixed Profile Light Rail*	1,400	200	1,900	1,800	5,300
SR 99 North Variation	1,300	200	1,600	1,600	4,700
L3: SR 99 Elevated Light Rail*	1,900	900	2,600	3,000	8,400
B2: Multi-Corridor BRT	900	700	400	500	2,500

*The Roosevelt Way Variation was not modeled, but is expected to result in slightly fewer transit trips between regional growth centers than the primary alternative because the 130th Street Station is not included.

5.1.3 Ability to Accommodate Demand

The ability of each alternative to provide the capacity to accommodate the forecasted demand in the corridor and give an indication of the potential to accommodate growth in ridership beyond the 2030 forecast horizon year is evaluated based on the following measures.

- **Person-carrying capacity per hour:** An estimate of maximum load person-carrying capacity based on infrastructure capacity and anticipated service levels.

- **Peak-hour ridership demand/operating capacity per hour:** A calculation of forecasted peak direction transit ridership demand for the segment north of Northgate divided by the operational person-carrying capacity of the alternative.

The L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative would provide the highest peak-period capacity of passengers per hour per direction, at 4-minute headways. The L2: SR 99 Mixed Profile Light Rail Alternative would provide half the carrying capacity of the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives because it is limited to 8 minute headways[2]. The B2: Multi-Corridor BRT Alternative would provide more than twice the capacity of the TSM/Baseline Alternative, but only about 30 percent of the capacity of the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives and about 60 percent of the capacity of the L2: SR 99 Mixed Profile Light Rail Alternative.

A summary of estimated carrying capacity and the ratio of peak-hour ridership demand to capacity is provided in Table 5-3. The carrying capacity amounts shown in Table 5-3 for the alternatives represent operating capacity assumptions of 148 passengers per car for light rail and 80 passengers per bus for BRT. The ratio provided in the table indicates how much of the operating capacity would be used by the forecasted peak-hour ridership demand in the peak direction for the peak segment of the line (which would be the segment north of Northgate Station). The operating capacity provided by the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives would accommodate the forecasted ridership demand in 2030 and would provide additional capacity for future ridership growth. The capacity provided by the L2: SR 99 Mixed Profile Light Rail Alternative would meet forecasted ridership demand; however, it would provide minimal capacity for future ridership growth or extension beyond Lynnwood. In addition, this alternative assumes that parallel commuter bus service would continue to operate in the I-5 corridor. If that bus service were to be truncated or discontinued, ridership demand would be expected to significantly increase for the L2: SR 99 Mixed Profile Light Rail Alternative, likely beyond the carrying capacity of the line at 8-minute headways. The reason that this bus service is assumed to remain with the L2: SR 99 Mixed Profile Light Rail Alternative is because, with the unreliability of at-grade operations, as well as 8-minute peak headways, it is anticipated that parallel express bus service from south Snohomish County would be as attractive as (if not more attractive than) rail service and would continue to serve a large share of riders. Elimination of that bus service is expected to result in an increase in demand for the light rail line. The variations (SR 99 North Variation and Roosevelt Way Variation) to the L2: SR 99 Mixed Profile Light Rail Alternative are expected to perform similarly to the primary alternative.

The TSM/Baseline Alternative is expected to be at capacity by the year 2030, while the B2: Multi-Corridor BRT Alternative would be approaching capacity, particularly on the highest demand

[2] When operating in an at-grade alignment on SR 99 as compared to the fully grade-separated L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives, which would operate at the 4-minute headways required by the system. As explained in Chapter 4, headways for the L2: SR 99 Mixed Profile Light Rail Alternative would be limited to 8 minutes because of the unreliability of at-grade train operations with 4-minute headways in the heavily congested SR 99 corridor.

route connecting Lynnwood and Northgate via I-5. The primary factor limiting the capacity of these alternatives is the volume of buses that can be accommodated at the expanded Northgate Transit Center. For the TSM/Baseline Alternative, the Lynnwood-to-Northgate route is anticipated to be over capacity, while the other routes would be able to accommodate the forecasted demand. In order to accommodate forecasted demand for the TSM/Baseline Alternative, peak period service frequencies would need to be increased to less than 2-minute headways. This would also be the case for accommodating demand for the B2: Multi-Corridor BRT Alternative beyond 2030, or if service were to be extended north to Everett. These frequencies would be extremely difficult to maintain and would require additional capacity at the Northgate Transit Center. Adding capacity to the Northgate Transit Center beyond the additional deck that is proposed for the B2: Multi-Corridor BRT Alternative may be difficult to accomplish and/or not cost-effective due to the expense of adding additional levels to the transit center or expanding its footprint.

Table 5-3. 2030 Maximum Person-Carrying Capacity

Alternative	Passengers per Hour per Direction*	Ratio of Peak-Hour Peak Direction Ridership to Capacity
TSM/Baseline	1,680	At capacity
L1: I-5 Light Rail	8,880	0.72
L2: SR 99 Mixed Profile Light Rail	4,440	0.95
L3: SR 99 Elevated Light Rail	8,880	0.62
B2: Multi-Corridor BRT	3,600	0.86

*Rail capacity based on an operating capacity of 148 passengers per vehicle. Bus capacity based on an operating capacity of 80 passengers per vehicle.

5.1.4 Travel Time

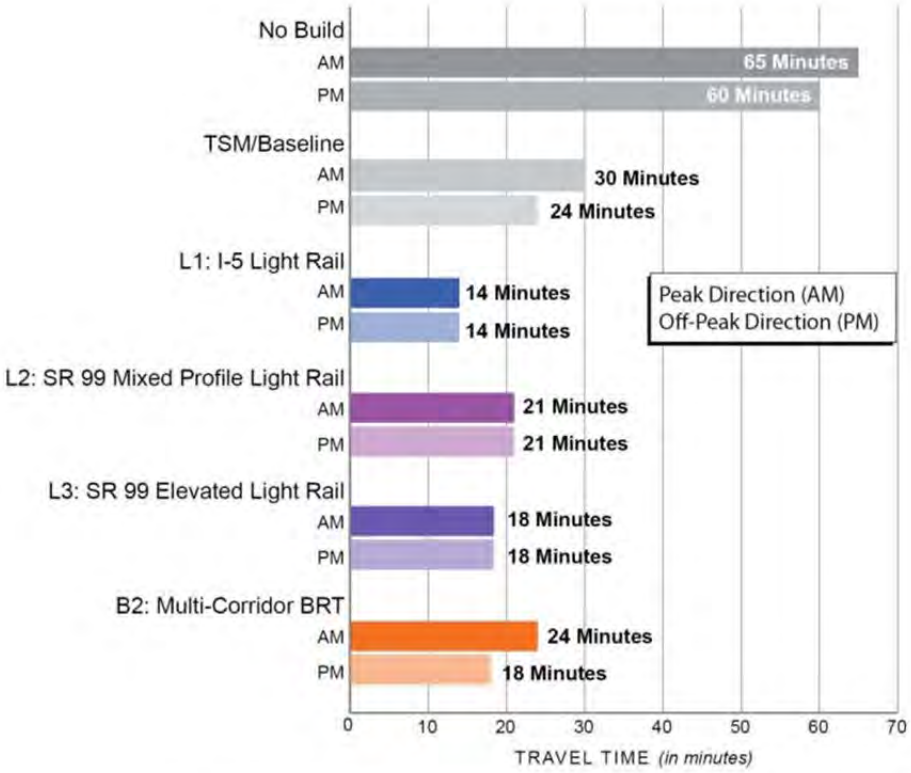
The measures in this category provide a comparison of estimated transit travel times among alternatives as well as a comparison to estimated automobile travel times. Travel times were compared for trips from Lynnwood and Shoreline to the selected regional growth centers of Northgate, University District, downtown Seattle, SeaTac, downtown Bellevue, and Overlake.

TRANSIT TRAVEL TIME

Year 2030 peak period transit travel times were estimated for the peak direction (AM southbound) and off-peak direction (PM southbound) based on estimated travel speeds and distance. Total travel times from Lynnwood and Shoreline to Northgate as well as six other representative regional centers were calculated. Transit travel time calculations assume travel south of Northgate is on the 2030 light rail system unless a faster bus alternative exists. Transit travel time routes from Shoreline begin at the Shoreline Park-and-Ride Station for all alternatives except for the L1: I-5 Light Rail Alternative, which begins at the I-5/185th Street

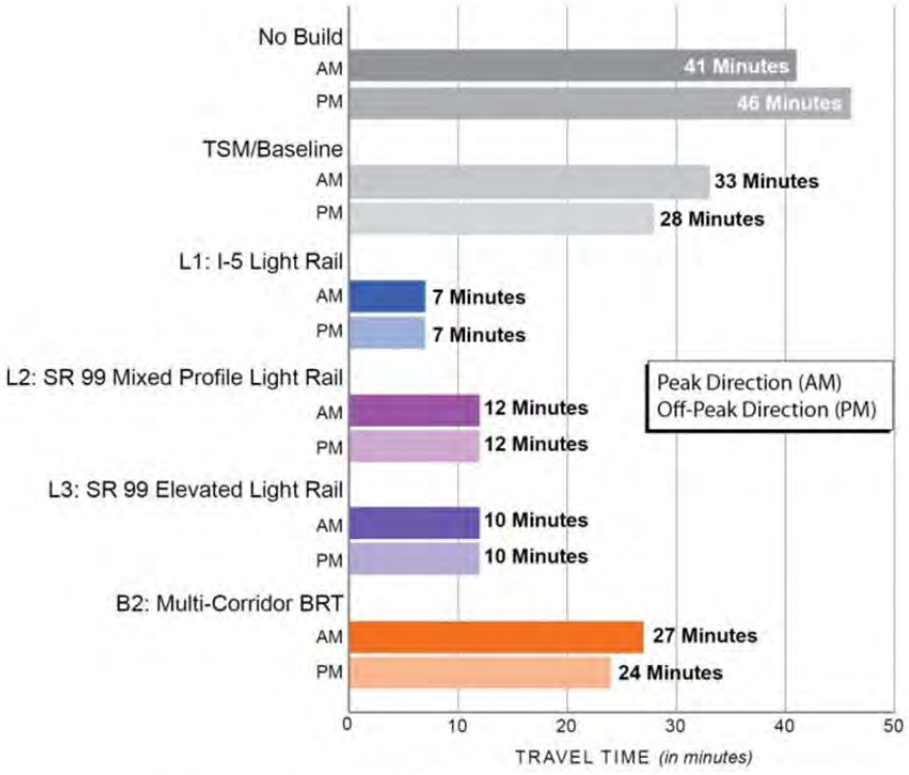
Station. Travel time routes from Lynnwood begin at the Lynnwood Transit Center for all alternatives.

Transit travel times from Lynnwood and Shoreline to Link light rail at Northgate are shown in Figures 5-8 and 5-9. Estimated travel times include dwell times at stations, in-vehicle travel time and, for bus alternatives, transfer time from bus to rail at Northgate. They do not include station access time. All of the alternatives would provide shorter travel times compared to the No Build Alternative, with the shortest being the L1: I-5 Light Rail Alternative.



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate. The SR 99 North Variation would increase travel time by approximately 2 minutes, while the Roosevelt Way Variation would increase travel time by approximately 2 minutes.

Figure 5-8. Estimated 2030 Travel Times from Lynnwood to Northgate



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate. The SR 99 North Variation would not affect travel time from Shoreline, while the Roosevelt Way Variation would decrease travel time by approximately 2 minutes.

Figure 5-9. Estimated 2030 Travel Times from Shoreline to Northgate

Peak direction travel times from Lynnwood to Northgate for the L2: SR 99 Mixed Profile Light Rail, L3: SR 99 Elevated Light Rail, and the B2: Multi-Corridor BRT Alternatives would be approximately 4 to 10 minutes longer than for the L1: I-5 Light Rail Alternative. In the off peak direction, the L1: I-5 Light Rail Alternative would be shorter by 4 to 7 minutes. Peak direction and off-peak direction travel times would differ for the bus alternatives because roadway congestion in the North Corridor varies by direction during peak periods, particularly during the PM peak period (Sound Transit 2010b). The SR 99 North Variation is estimated to be 2 minutes slower than the primary L2: SR 99 Mixed Profile Light Rail Alternative from Lynnwood to Northgate. The Roosevelt Way Variation is estimated to be 2 minutes faster than the primary alternative due to a reduction in the amount of at-grade alignment and elimination of one station (SR 99 at North 130th Street).

For trips from Shoreline to Northgate, the L1: I-5 Light Rail Alternative would provide the shortest travel time. The travel time advantage for the light rail alternatives over the TSM/Baseline and B2: Multi-Corridor BRT Alternatives would be greater for the trips from Shoreline due to bus travel on arterials for a portion of the trip to serve the Shoreline area, as well as a lack of direct access to the I-5 HOV lanes in the TSM/Baseline Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative and SR 99 North Variation alignments and travel times would

be identical between Shoreline and Northgate, while the Roosevelt Way Variation would reduce the travel time by 2 minutes.

Transit travel times from Lynnwood and Shoreline to selected PSRC-designated Regional Growth Centers are shown in Tables 5-4 through 5-7, and illustrated for selected centers in Figures 5-10 and 5-11. Estimated travel times shown in these tables and figures include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate. In cases where the travel time for a build alternative is longer than existing transit service, some users may choose the faster existing service. However, some may choose the slower build alternative due to increased reliability and frequency of service.

Table 5-4. Estimated 2030 Transit Peak Period, Peak Direction, Travel Times (minutes) from Lynnwood to Selected Regional Growth Centers

Alternative	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	25	52	43	88	49	68
TSM/Baseline	35	41	45	77	68	79
L1: I-5 Light Rail	19	25	29	61	52	63
L2: SR 99 Mixed Profile Light Rail	26	32	36	68	59	70
L3: SR 99 Elevated Light Rail	23	29	33	65	56	67
B2: Multi-Corridor BRT	29	35	39	71	62	73

Note: Estimated travel times include dwell times at stations and, for bus alternatives to centers beyond Northgate, transfer time from bus to rail.

Table 5-5. Estimated 2030 Transit Peak Period, Off-Peak Direction, Travel Times (minutes) from Lynnwood to Selected Regional Growth Centers

Alternative	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	43	77	44	89	55	81
TSM/Baseline	29	35	39	71	62	73
L1: I-5 Light Rail	19	25	29	61	52	63
L2: SR 99 Mixed Profile Light Rail	26	32	36	68	59	70
L3: SR 99 Elevated Light Rail	23	29	33	65	56	67
B2: Multi-Corridor BRT	23	29	33	65	56	67

Note: Estimated travel times include dwell times at stations and, for bus alternatives to centers beyond Northgate, transfer time from bus to rail.

Table 5-6. Estimated 2030 Transit Peak Period, Peak Direction, Travel Times (minutes) from Shoreline to Selected Regional Growth Centers

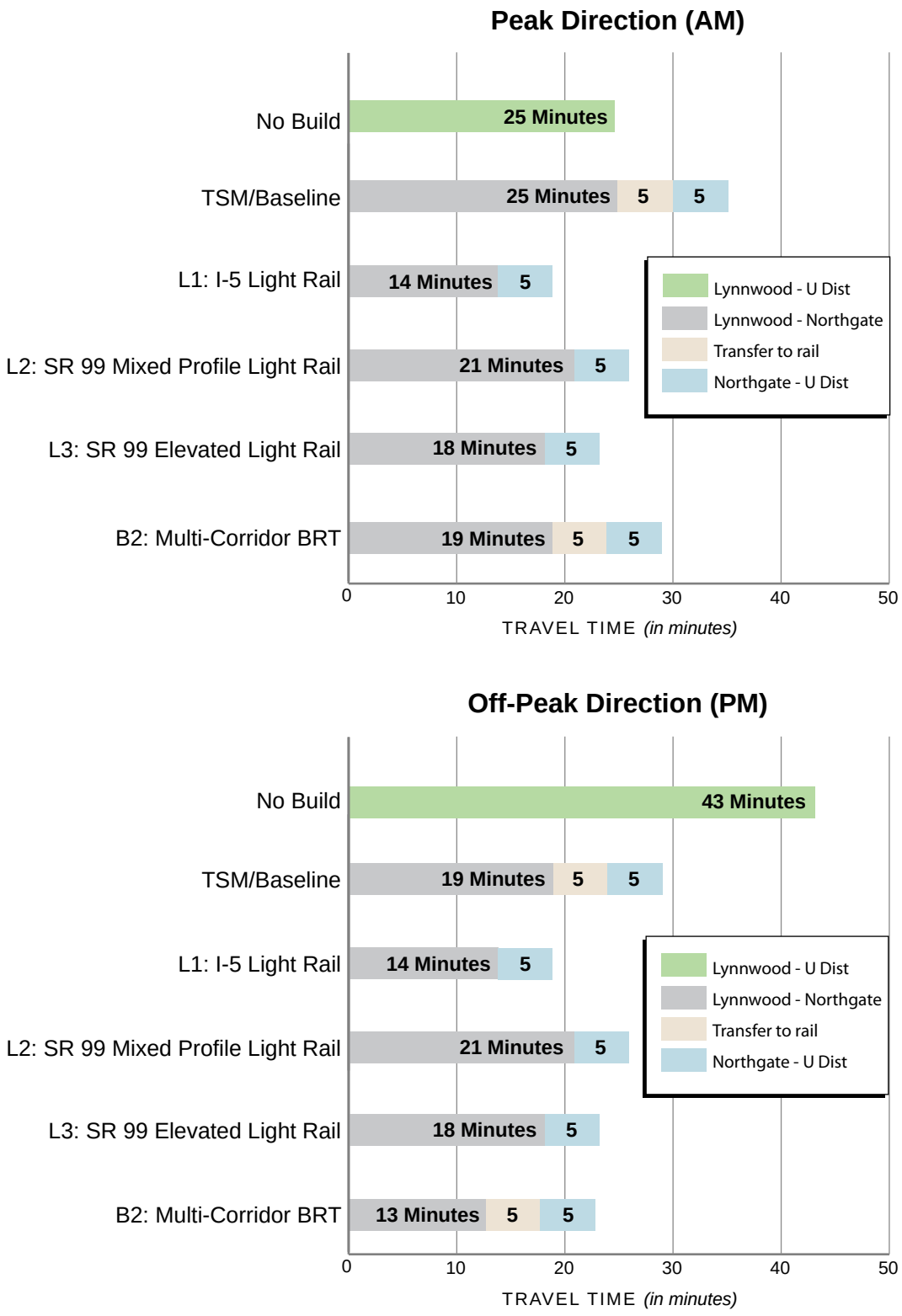
Alternative	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	49	45	33	74	76	89
TSM/Baseline	38	44	48	80	71	82
L1: I-5 Light Rail	12	18	22	54	45	56
L2: SR 99 Mixed Profile Light Rail	17	23	27	59	50	61
L3: SR 99 Elevated Light Rail	15	21	25	57	48	59
B2: Multi-Corridor BRT	32	38	42	74	65	76

Note: Estimated travel times include dwell times at stations and, for bus alternatives to centers beyond Northgate, transfer time from bus to rail.

Table 5-7. Estimated 2030 Transit Peak Period, Off-Peak Direction, Travel Times (minutes) from Shoreline to Selected Regional Growth Centers

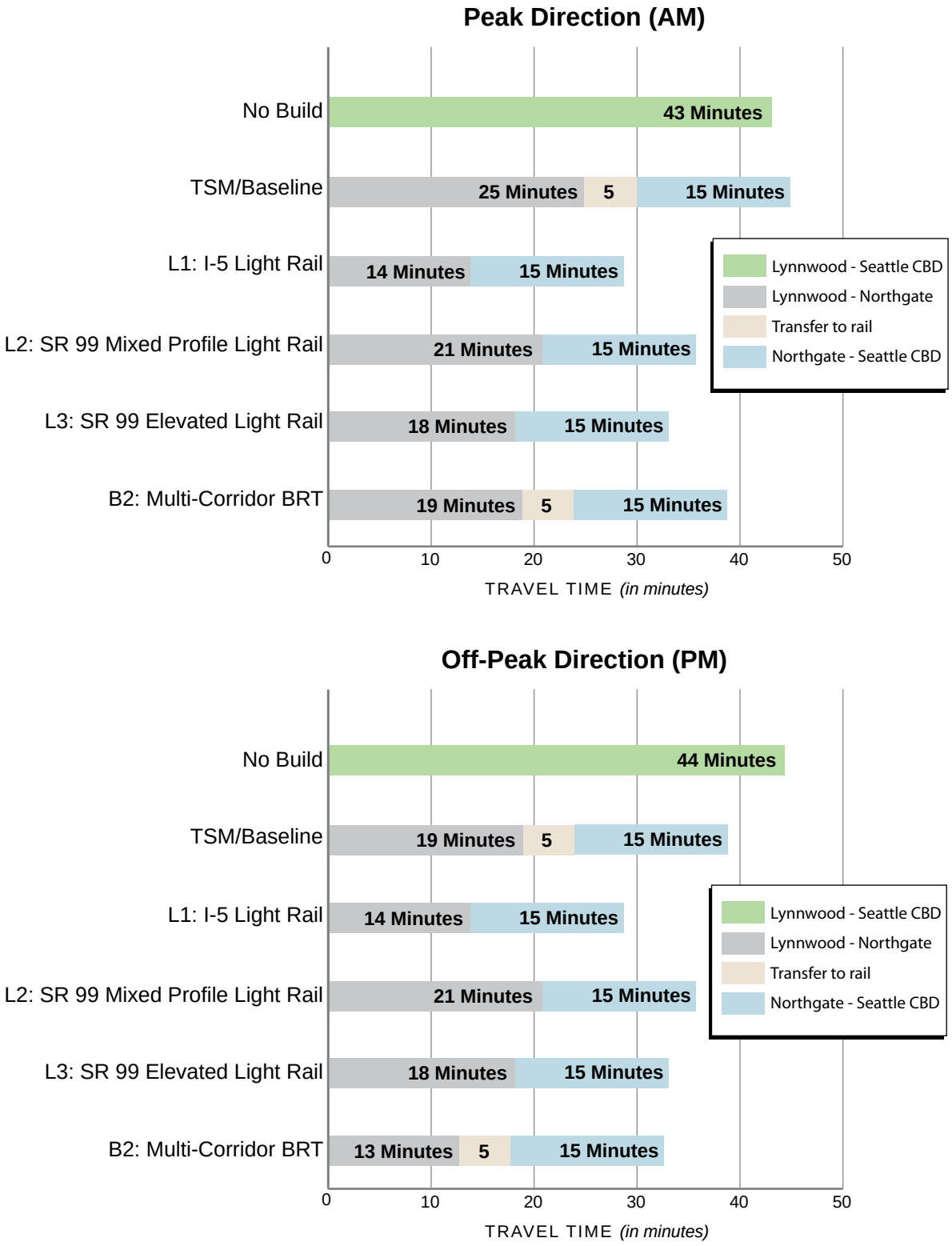
Alternative	U. Dist.	Cap. Hill	Seattle CBD	SeaTac	Bellevue CBD	Overlake
No Build	63	79	42	87	92	81
TSM/Baseline	33	39	43	75	66	77
L1: I-5 Light Rail	12	18	22	54	45	56
L2: SR 99 Mixed Profile Light Rail	17	23	27	59	50	61
L3: SR 99 Elevated Light Rail	15	21	25	57	48	59
B2: Multi-Corridor BRT	29	35	39	71	62	73

Note: Estimated travel times include dwell times at stations and, for bus alternatives to centers beyond Northgate, transfer time from bus to rail.



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate.

Figure 5-10. 2030 Transit Peak Period Travel Times from Lynnwood to University District



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate.

Figure 5-11. 2030 Transit Peak Period Travel Times from Lynnwood to Downtown Seattle

TRAVEL TIME COMPARISON—TRANSIT VS. AUTOMOBILE

A comparison of peak period travel times for key travel time pairs was also made using the same general methodology as for the transit travel time measure. Estimated 2030 transit and automobile travel times from Lynnwood to selected PSRC-designated Regional Growth Centers are illustrated in Figures 5-12 and 5-13. Estimated automobile travel times are based on observed travel times (WSDOT loop detectors, 2008) and speed degradation through 2030 derived from the regional travel demand model.

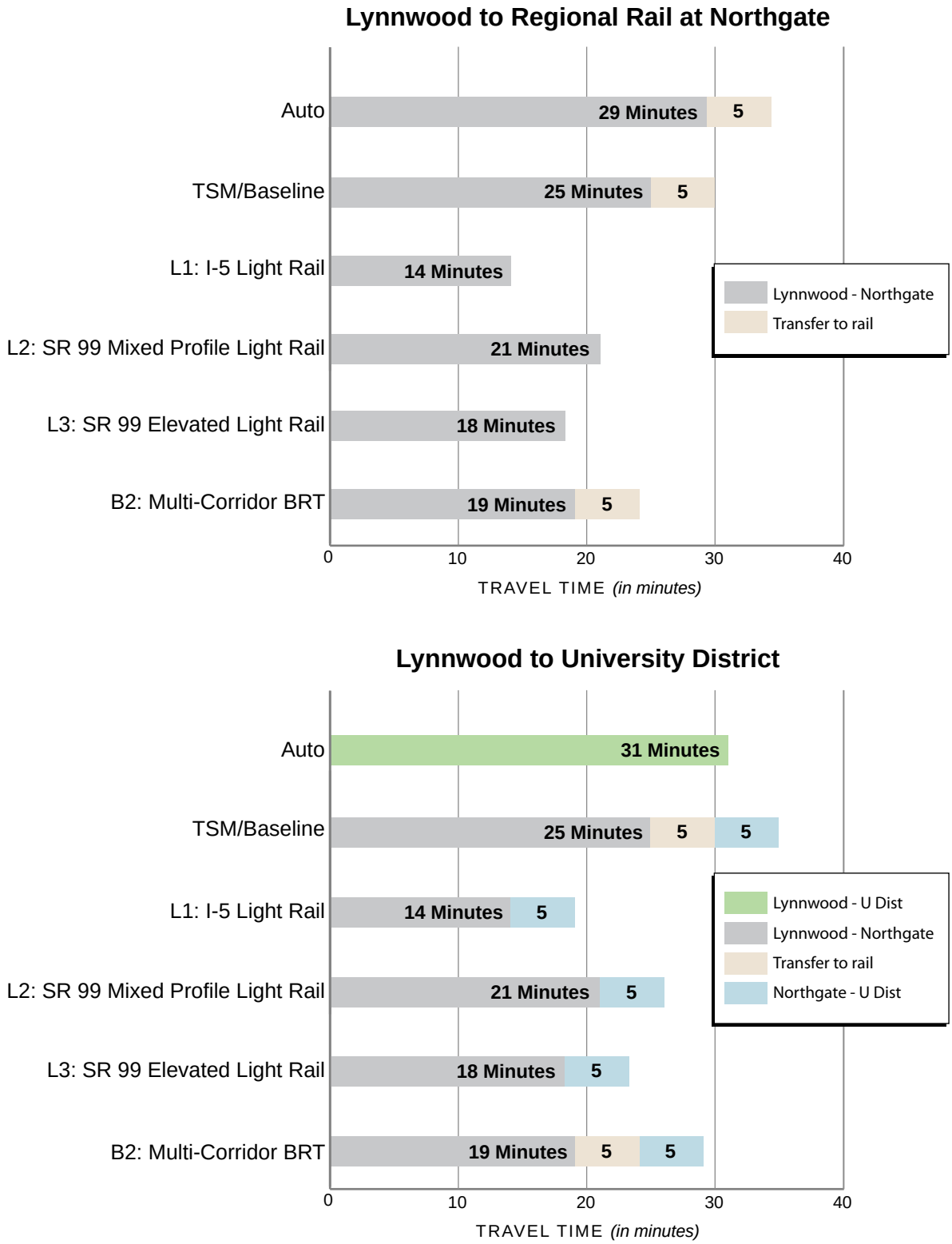
As shown in Figure 5-12, the automobile travel time from Lynnwood to regional light rail at Northgate is expected to be approximately 4 minutes longer than the TSM/Baseline Alternative, at approximately 34 minutes. This is approximately 10 minutes longer than the B2: Multi-Corridor BRT Alternative, and approximately 10 to 16 minutes longer than the light rail alternatives. The automobile travel time to the University District is expected to be 4 minutes shorter than the TSM/Baseline Alternative and 2 to 12 minutes longer than the B2: Multi-Corridor BRT Alternative and light rail alternatives. The automobile travel time to downtown Seattle is expected to be shorter than the TSM/Baseline Alternative, similar to the B2: Multi-Corridor BRT Alternative, and longer than the light rail alternatives. For trips to Sea Tac Airport, automobile travel times are expected to be 8 to 24 minutes shorter than the bus and light rail alternatives.

5.1.5 Transit Reliability

The following measures provide an assessment of the alternatives based on the operational conditions that affect transit travel time reliability: miles of alignment in non-exclusive right of-way, number of at-grade signalized intersections traversed, and number of transfers required to reach major destinations.

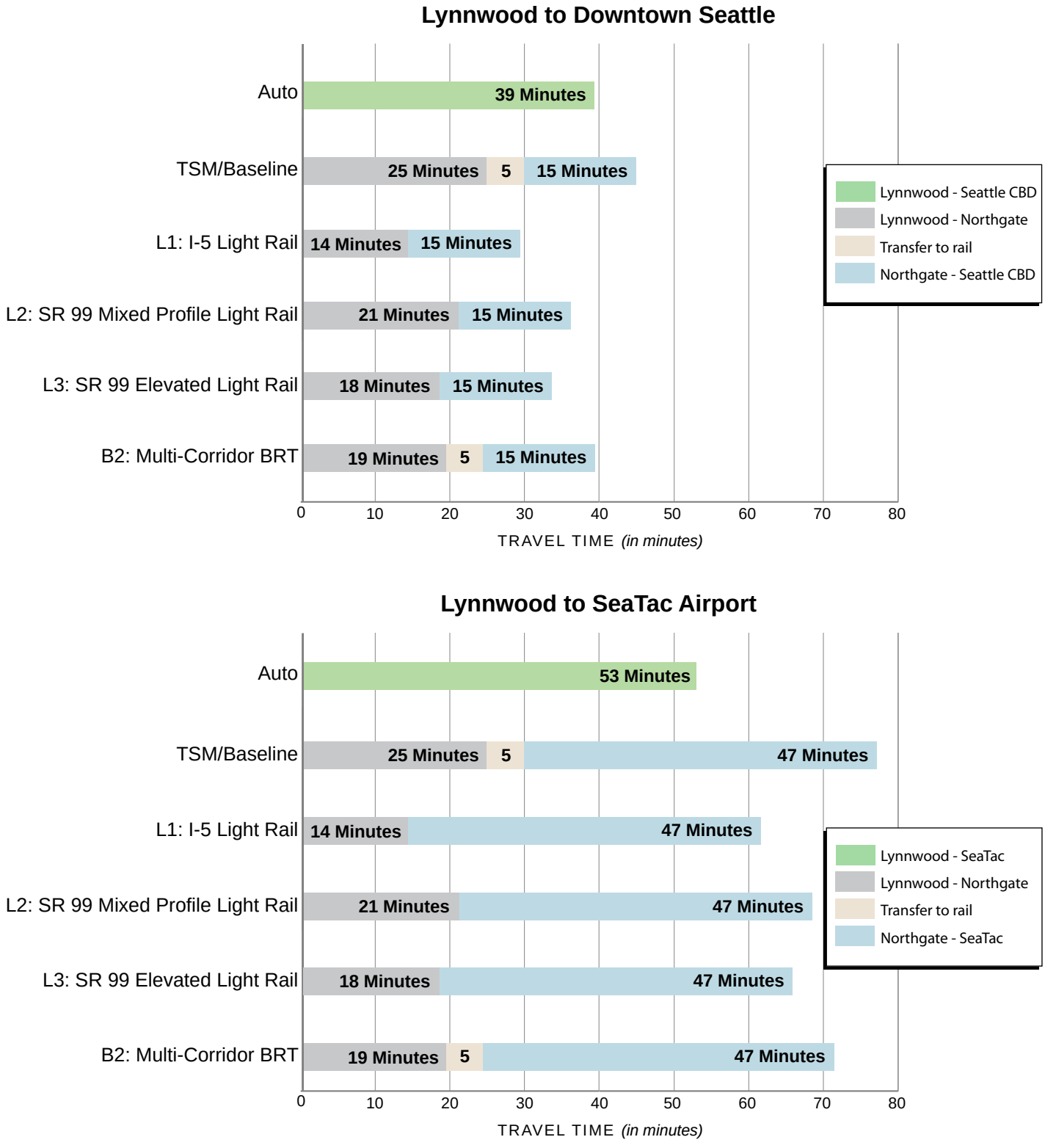
MILES OF NON-EXCLUSIVE GUIDEWAY

Transit travel in non exclusive right-of-way means that the travel time would vary by time of day depending on roadway congestion levels and be subject to the same frequently occurring but unpredictable delays resulting from traffic incidents such as vehicle breakdowns and accidents. The approximate miles of operation on non-exclusive guideway associated with each alternative is presented in Table 5-8 by alternative. For the TSM/Baseline Alternative, buses on the I-5 Lynnwood-to-Northgate route would be required to use the existing general purpose on- and off-ramps at Northgate and navigate on local arterials with general purpose traffic to reach the transit center. (Transit-only lanes would provide some travel time savings for buses using the I-5 southbound off-ramp and northbound on-ramp at Northgate.) The HOV lanes (non-exclusive guideway) on I-5 do not currently meet the WSDOT performance standard of 45-mph travel speed in HOV lanes during peak periods.



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate.

Figure 5-12. 2030 Peak Period, Peak Direction, Travel Times from Lynnwood to Northgate and University District - Transit vs. Automobile



Note: Estimated travel times include dwell times at stations and, for bus alternatives, transfer time from bus to rail at Northgate.

Figure 5-13. 2030 Peak Period, Peak Direction, Travel Times from Lynnwood to Downtown Seattle and SeaTac Airport - Transit vs. Automobile

Table 5-8. Miles of Operation on Non-Exclusive Guideway

Alternative	Miles of Operation on Non-Exclusive Guideway
TSM/Baseline	23.8
L1: I-5 Light Rail	0
L2: SR 99 Mixed Profile Light Rail	0
L3: SR 99 Elevated Light Rail	0
B2: Multi-Corridor BRT	25.8

Transportation 2040 (PSRC 2010a), the region's Long-Range Plan calls for eventual development of managed lanes along this portion of I-5. WSDOT is considering a number of options that could result in major reconstruction and tolling of portions of the freeway to develop one or more managed lanes in each direction of I-5 between Northgate and Lynnwood. If implemented and successfully managed, these improvements should reduce peak period travel times by as much as 5 minutes and provide better reliability for buses operating in this section of I-5. However, at this time, the design, construction costs, right-of-way, transportation system, environmental effects, and funding of these improvements are not known.

The light rail alternatives all would operate on completely exclusive guideway, regardless of whether they are elevated or at-grade. The B2: Multi-Corridor BRT Alternative would operate on the greatest number of miles of non-exclusive guideway due to the combined length of its three routes. Although the I-5 HOV lanes and SR 99 BAT lanes are considered non-exclusive guideway, the lanes would offer a level of priority that provides some reliability benefit over general purpose lanes.

NUMBER OF AT-GRADE SIGNALIZED INTERSECTIONS AND CONGESTION

The number of at-grade signalized intersections traversed and the number of highly congested intersections for each alternative is provided in Table 5-9. The TSM/Baseline Alternative, with three express bus routes, would traverse 30 signalized intersections, with 11 of them highly congested.

Table 5-9. Number of At-Grade Signalized Intersections Traversed and Congestion

Alternative	Number of At-Grade Signalized Intersections Traversed	Highly Congested* Signalized Intersections
TSM/Baseline	30	11
L1: I-5 Light Rail	0	0
L2: SR 99 Mixed Profile Light Rail	5	2
Roosevelt Way Variation	2	0
SR 99 North Variation	11	4
L3: SR 99 Elevated Light Rail	0	0
B2: Multi-Corridor BRT	50	13

*Highly congested signalized intersections are defined as intersections operating at or over capacity (LOS E or F) with heavy to severe delay.

The L1: I-5 Light Rail Alternative and the L3: SR 99 Elevated Alternative would not traverse any at-grade signalized intersections, while the L2: SR 99 Mixed Profile Light Rail Alternative would traverse five at-grade signalized intersections, with two of those being highly congested. The Roosevelt Way Variation would not have the at-grade section between North 125th Street and North 143rd Street; this variation would traverse only two signalized intersections with none of them highly congested. The SR 99 North Variation would follow SR 99 north of SR 104/Ballinger Way rather than travel on Ballinger Way and then turn east of 208th Street SW. The segment north of SR 104 would traverse 6 additional at-grade signalized intersections, with 2 of them highly congested, for a total of 11 intersections, 4 of which are highly congested.

The B2: Multi-Corridor BRT Alternative, with three express bus/BRT routes and direct access into and out of the Northgate Transit Center, as well as direct access to and from the south at North 130th Street, would traverse 50 signalized intersections, with 13 of those highly congested.

NUMBER OF TRANSFERS REQUIRED TO REACH MAJOR DESTINATIONS

Each transfer made to reach a destination introduces another source of travel time unreliability and day-to-day variation. Both the TSM/Baseline and the B2: Multi-Corridor Alternatives would require a transfer to light rail at Northgate in order to reach destinations south of Northgate via the regional light rail system, adding time to those trips. The light rail alternatives would not require a transfer at Northgate to reach the same destinations.

5.1.6 System-Wide Vehicle Miles Traveled

This system-wide measure provides information on travel characteristics relative to each alternative and is used as input for calculation of several environmental measures. Total system VMT can serve as an indicator of mode shift. For example, a reduction in VMT is often due to a shift from automobile to transit. System-wide statistics for reduction in daily VMT are provided in Table 5-10.

The reduction in overall system daily VMT with the L1: I-5 Light Rail Alternative would be more than twice the reduction that would result from the L2: SR 99 Mixed Profile Light Rail Alternative. The VMT reduction with the L3: SR 99 Elevated Light Rail Alternative would be less than that of the L1: I-5 Light Rail Alternative, but still almost double that of the L2: SR 99 Mixed Profile Light Rail Alternative. The VMT reduction with the B2: Multi-Corridor BRT Alternative would be less than half that of the L2: SR 99 Mixed Profile Light Rail Alternative, while the reduction with the TSM/Baseline Alternative would be half that of the B2: Multi-Corridor BRT Alternative. This indicates that the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives would have a greater effect on reducing automobile travel than the other alternatives.

Table 5-10. Year 2030 Highway Performance Measures

Alternative	Reduction in Daily VMT
TSM/Baseline	16,900
L1: I-5 Light Rail	191,500
L2: SR 99 Mixed Profile Light Rail*	85,200
SR 99 North Variation	75,200
L3: SR 99 Elevated Light Rail	160,700
B2: Multi-Corridor BRT	33,100

*The Roosevelt Way Variation was not modeled, but is expected to result in slightly less VMT reduction than the primary alternative

5.1.7 Transit Service Accessibility

Transit service accessibility is measured by the quality of pedestrian, bicycle, feeder bus, and automobile access to the transit stations. Other modes such as automobile access by individuals with disabilities and drop-off passengers will be addressed in the station design and will be defined during the design phase, consistent with Sound Transit policies.

Pedestrian and bicycle accessibility is evaluated for each alternative based on the amount of geographic area accessible within a 15 minute walk and a 15-minute bicycle ride. The following qualitative factors were used to determine how each alternative is rated for pedestrian and bicycle accessibility:

- **Connectivity of local streets**—Greater connectivity means that a greater area is accessible by walking or biking. A closely spaced grid of local streets provides the highest level of connectivity and accessibility.
- **Barriers**—Barriers limit the area accessible by walking and biking. I-5, for example, is a barrier that requires pedestrians and bicycles to cross the freeway at a limited number of locations, potentially resulting in a much smaller area across I-5 that is accessible within a 15-minute walk shed. Streams, open space, and large contiguous land uses (e.g., golf courses and cemeteries) also have a barrier effect, limiting the size of residential or commercial areas that are within a 15 minute walk shed to the transit station.
- **Presence of sidewalks on arterial streets**—Arterial streets provide the primary access to the stations. Many arterials within the North Corridor project area lack sidewalks. Stations located in the vicinity of arterials with sidewalks result in a higher rating for accessibility.

The resulting pedestrian and bicycle accessibility scores were summed for all stations under each alternative and then the alternatives were rated as high, moderate, and low based on these scores.

The accessibility of transit stations by bus is measured by the number of existing bus routes passing within 0.25 mile of a transit station. The number of bus routes that could provide connectivity to the transit alternative was summed for the stations under each alternative, and then the alternatives were rated as high, moderate, and low based on the results.

Because land use patterns in the North Corridor are generally suburban, park-and-ride facilities are needed to bring substantial volumes of passengers to the stations. As the areas surrounding the stations continue to urbanize, the role of park and-ride access to stations would likely diminish. In order to assess the ability for automobiles to access transit stations, the number of park-and-ride stalls by alternative was summed for the stations under each alternative and then the alternative was ranked as high, moderate, and low based on the results.

A detailed evaluation was compiled and the accessibility by mode for each alternative was assigned a relative result with 3 being the highest and 1 the lowest. The priority for providing convenient and direct access to stations was established by the Link Light Rail North Link Design Criteria Manual (Sound Transit 2009).

Modal priority identified in this manual is listed as follows in descending order of importance:

- Pedestrian
- Individual with disability—non-driver (Paratransit)
- Bus or commuter rail
- Individual with disability—self driver (at park-and-ride facilities)
- Bicycle
- Drop-off passengers (including non-driver individual with disability)
- Taxi
- Park-and-ride
- Motorcycle

Accordingly, in the evaluation of various access characteristics at stations, of the four access modes assessed, pedestrian access was given the highest weighting at 2.0 and park-and-ride the lowest at 0.5. A summary of accessibility results by mode is presented in Table 5-11 for each alternative.

Table 5-11. Service Accessibility

Mode	Weight	TSM/Baseline	L1: I-5 Light Rail	L2: SR 99 Mixed Profile Light Rail*	L3: SR 99 Elevated Light Rail	B2: Multi-Corridor BRT
Pedestrian	2.0	3	2	2	2	3
Bus Connectivity	1.5	3	2	2	2	3
Bicycle	1.0	3	2	2	2	3
Park-and-Ride Availability	0.5	3	2	2	2	2
Overall Rating		High	Moderate	Moderate	Moderate	High

Scale: 3 = high, 2 = moderate, and 1 = low.

* The overall rating for the Roosevelt Way Variation and the SR 99 North Variation would be the same as for the primary alternative, "Moderate"

The 15-minute pedestrian and bicycle travel sheds for each station area are presented in Figures 5-14 to 5-17. For pedestrians, the 15-minute walk is based on a 3-mph walking speed, or a distance of 3,960 feet from a station location. For bicycles, the 15 minute travel shed is based on a bicycling speed of 7 mph, or a distance of 1.75 miles. For the purposes of this exercise, neither the pedestrian nor bicycle speeds were adjusted for topography. The travel distance was measured with geographic information system (GIS) mapping along public roadways and walking/cycling paths. The distance was measured from station locations up to a parcel edge. For large parcels, the distance was measured to the known entrance to the property (e.g., the entrance to the Jackson Park Golf Course is on the southeast portion of the parcel). The pedestrian and bicycle travel sheds, when evaluated by station and alternative, do not dramatically distinguish between alternatives.

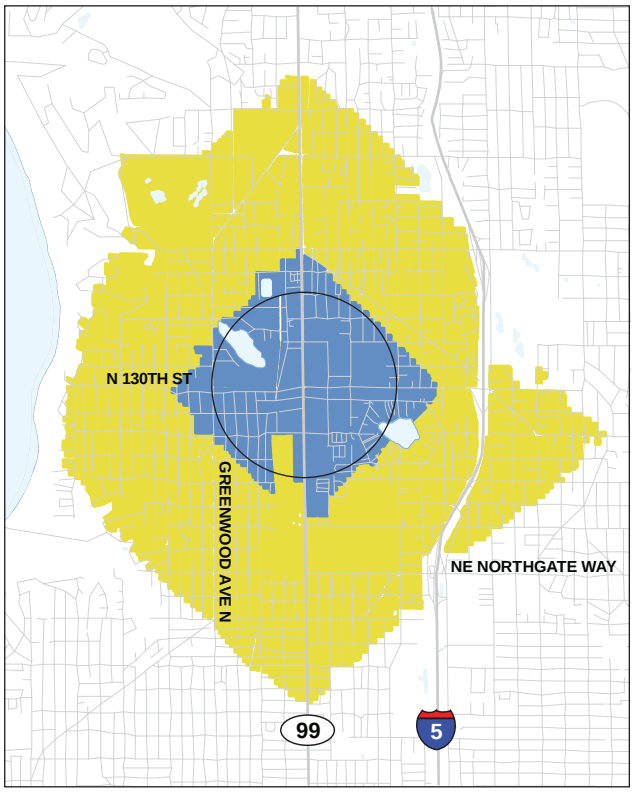
The travel shed diagrams illustrate where the lack of local street connectivity could limit accessibility in the area within a 15 minute walk or bike travel distance of each station. The travel sheds also show physical barriers between the transit station and nearby areas within the 15-minute walk shed, such as open/green space, golf courses, and cemeteries.

Overall, accessibility for all modes would be improved with implementation of any alternative. Facility development would include improvements to the pedestrian and bicycling environment in the immediate vicinity of stations, provision for passengers being dropped off, and taxi facilities, as well as access for individuals with disabilities. These improvements will be further defined during the design phase, consistent with Sound Transit policies.

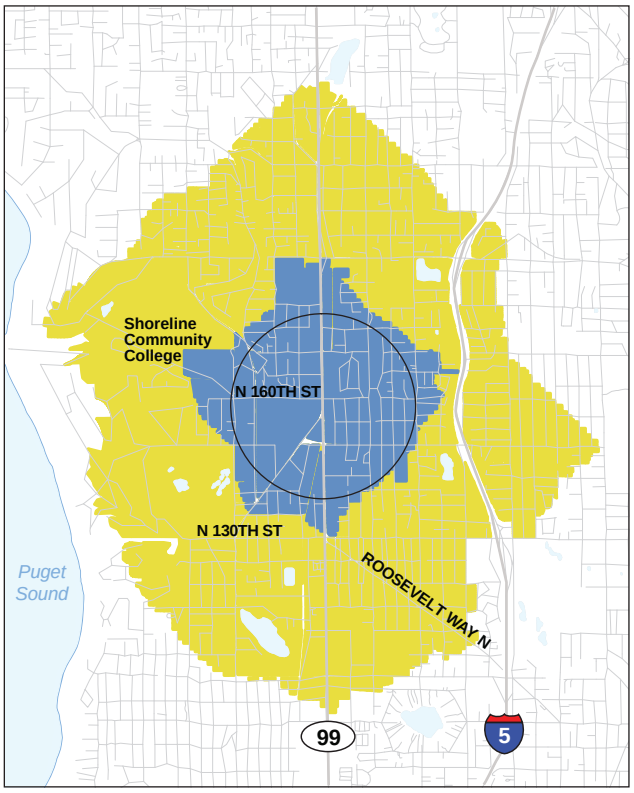
For the TSM/Baseline Alternative, accessibility to bus stops would be equal to the B2: BRT Multi-Corridor Alternative and higher than the light rail alternatives. The Edmonds Park and Ride, 19th Avenue NE/Ballinger Way, and 15th Avenue NE/North 175th Street areas would provide the highest level of pedestrian and bicycle accessibility because of the well developed sidewalk network. Lower levels of accessibility would exist at the other bus stop and station areas due to barriers, limited local street connectivity, and limited sidewalks on arterials.

There are 69 existing bus routes at or near the nine station areas that could provide connectivity to the three TSM/Baseline Alternative bus routes, resulting in a high rating for bus connectivity. The TSM/Baseline Alternative also includes the highest number of planned park-and-ride spaces, at 4,640.

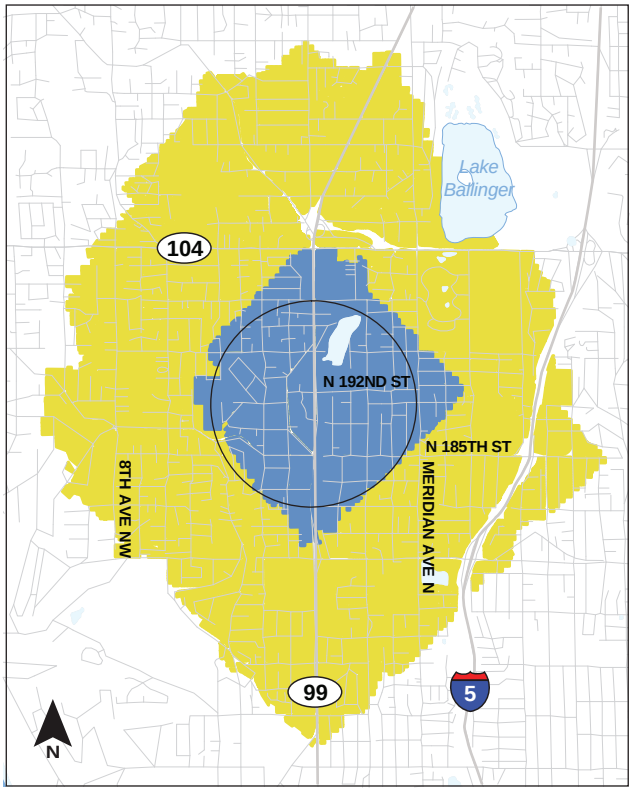
For the L1: I-5 Light Rail Alternative, a high level of accessibility would be provided at the North 185th Street station area, though the current large school district parcel immediately adjacent to the station may present an obstacle for pedestrians and cyclists. The remaining three station areas would provide lower levels of accessibility due to the presence of I-5 and lack of sidewalks on surrounding arterial streets. There are 40 existing bus routes at or near the four station areas that could provide connectivity to the L1: I-5 Light Rail Alternative, resulting in an average rating for bus connectivity. The L1: I-5 Light Rail Alternative includes 3,790 planned park-and-ride spaces, resulting in a moderate rating for this type of accessibility.



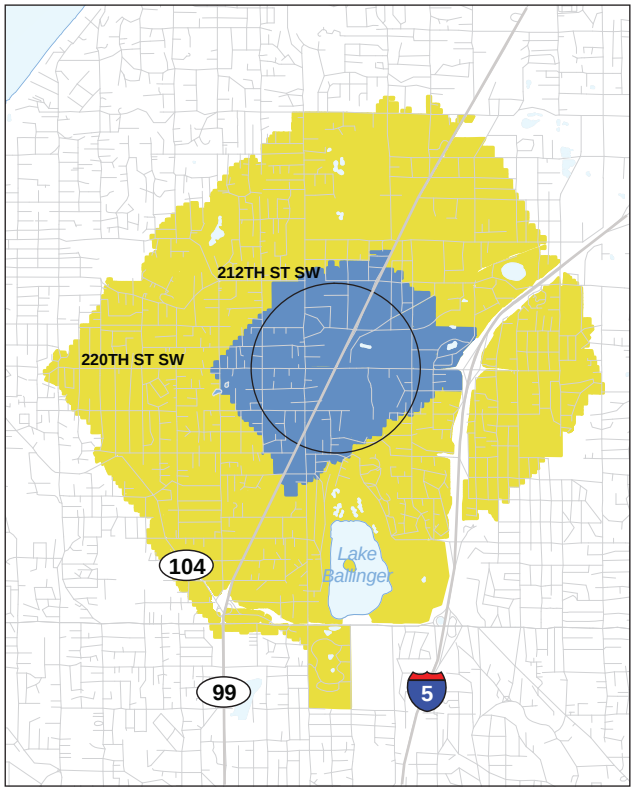
SR 99/130TH STREET



SR 99/160TH STREET



SHORELINE PARK-AND-RIDE



SR 99/220TH STREET

15-minute Walk Shed — Walk speed = 3 Miles per hour

15-minute Bike Shed — Bike speed = 7 Miles per hour

0.5 Mile Radius Station Area

Figure 5-14. 15-Minute Pedestrian and Bicycle Travel Sheds at the SR 99/130th Street, SR 99/160th Street, Shoreline Park-and-Ride and SR 99/220th Street Stations

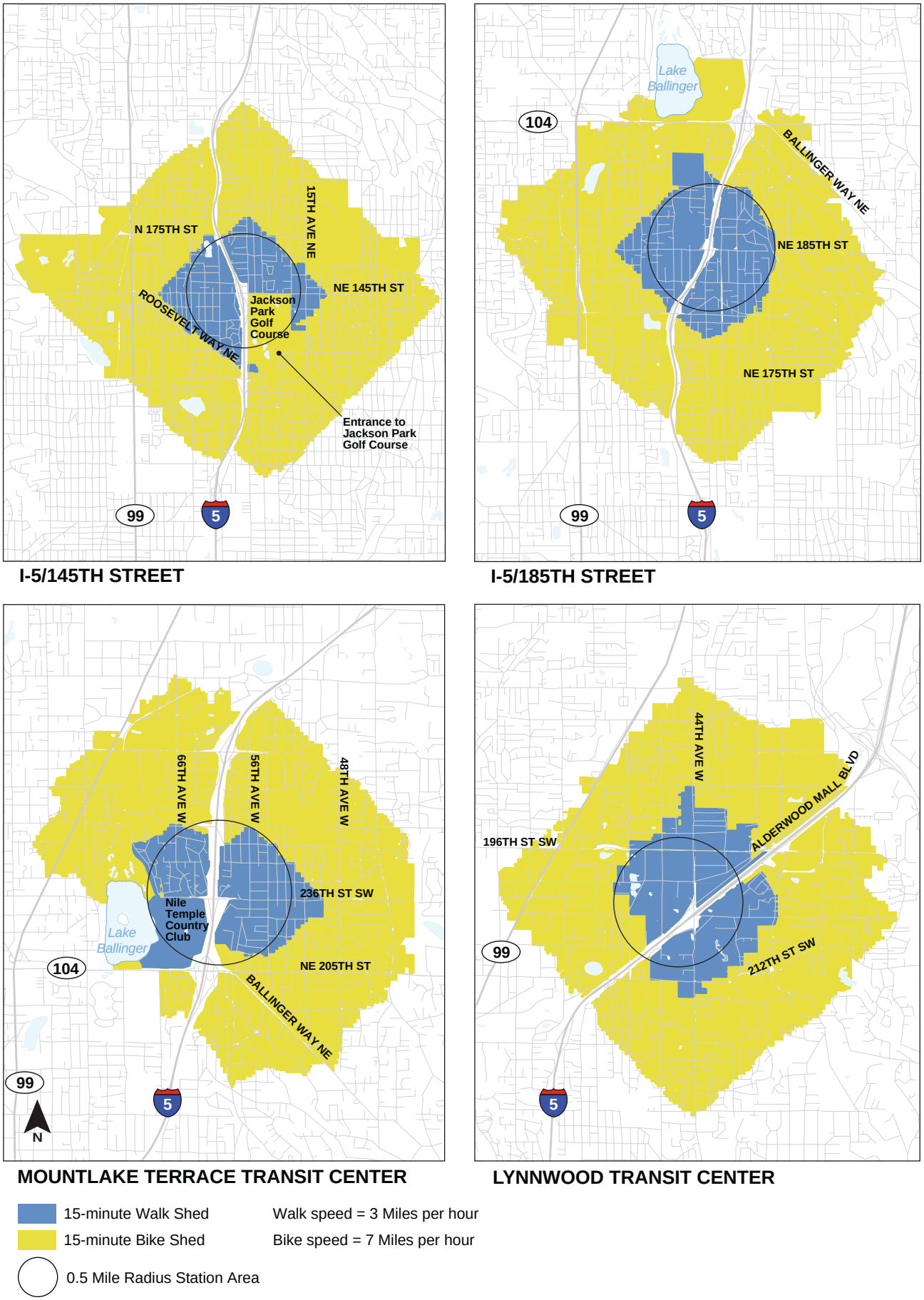


Figure 5-15. 15-Minute Pedestrian and Bicycle Travel Sheds at the I-5/145th Street, I-5/185th Street, Mountlake Terrace and Lynnwood Transit Center Stations

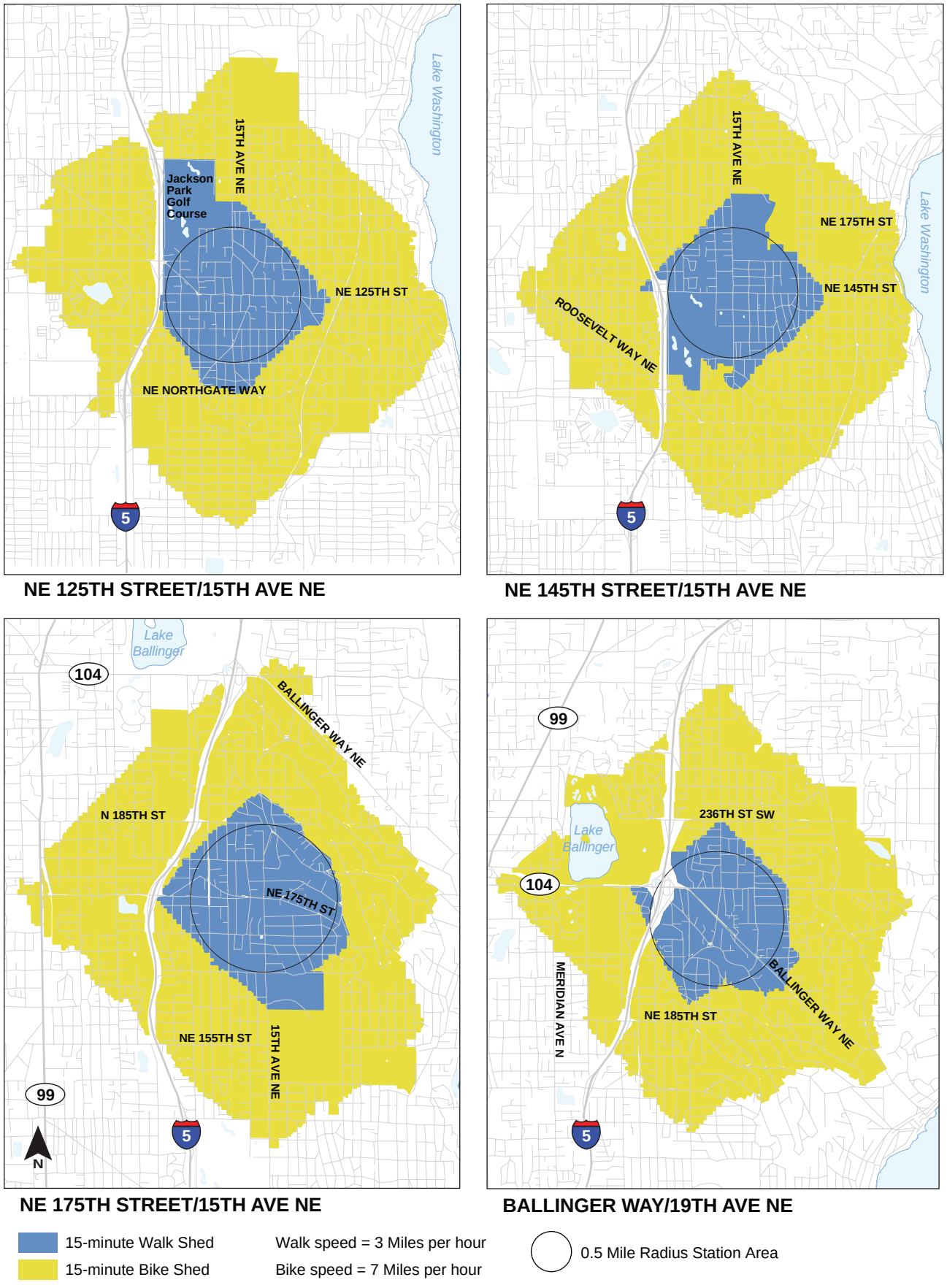


Figure 5-16. 15-Minute Pedestrian and Bicycle Travel Sheds at NE 125th Street/15th Avenue NE, NE 145th Street/15th Avenue NE, NE 175th Street/15th Avenue NE and Ballinger Way/19th Avenue NE Stations

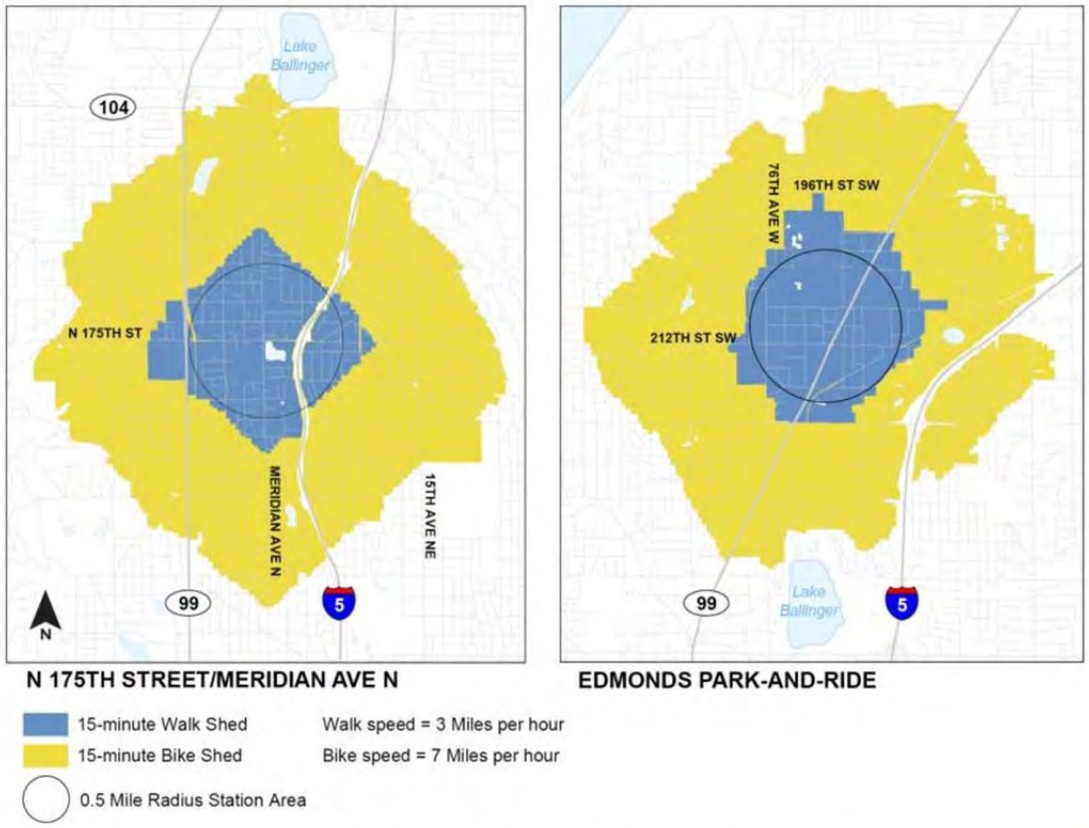


Figure 5-17. 15-Minute Pedestrian and Bicycle Travel Sheds at North 175th Street/Meridian Avenue North and Edmonds Park-and-Ride Stations

For the L2: SR 99 Mixed Profile Light Rail Alternative, the stations at North 160th Street and North 130th Street have average to slightly above average accessibility due to the absence of barriers for pedestrians. However, most station areas lack sidewalks on arterials leading to the stations. Along at-grade sections, pedestrian crossings of SR 99 to access light rail stations can only occur at signalized intersections. Stations located in the median of SR 99, while providing equal distance from either side of road, could require riders to cross as many as five traffic lanes. The Roosevelt Way Variation would result in a slightly lower accessibility rating than the primary alternative because it has one less station (the North 130th Street/SR 99 Station). The SR 99 North Variation includes a station at SR 99/220th Street SW rather than at the Mountlake Terrace Transit Center. The 220th Street SW station area has a slightly lower accessibility rating than the Mountlake Terrace station and would result in a slightly lower accessibility rating for the SR 99 North Variation than for the primary L2: SR 99 Mixed Profile Light Rail Alternative.

There are 45 existing bus routes at or near the five station areas of the L2: SR 99 Mixed Profile Light Rail Alternative, approximately the same as for the L1: I-5 Light Rail Alternative. This results in a moderate rating for bus connectivity. The L2: SR 99 Mixed Profile Light Rail Alternative includes 3,890 planned park-and-ride spaces, slightly more than the L1: I-5 Light Rail Alternative. The Roosevelt Way Variation and the SR 99 North Variation have slightly fewer connecting bus routes. Also, because the Mountlake Terrace Transit Center would not be

served under the latter variation and there are no planned park-and-ride spaces at SR 99/220th Street SW, there would be 890 fewer planned park-and-ride spaces along the SR 99 North Variation compared to the primary alternative. (Some users may choose to park at the Edmonds Park-and-Ride facility and then ride light rail; however, that facility is approximately one-third of a mile away from the 220th Street Station and is therefore not included in the park-and-ride capacity along the SR 99 North Variation.)

For the L3: Elevated Light Rail Alternative, the accessibility evaluation results in the same (moderate) rating as the L2: Mixed Profile Alternative. However, pedestrian crossing distances would change relative to the at-grade median stations of the L2: SR 99 Mixed Profile Light Rail Alternative. An elevated station located on the west side of SR 99 would require pedestrians accessing from the east side to cross the entire width of SR 99.

There are 45 existing bus routes at or near the five station areas of the L3: Elevated Light Rail Alternative, the same as for the L2: SR 99 Mixed Profile Light Rail Alternative. This results in a moderate rating for bus connectivity. The L3: Elevated Light Rail Alternative includes 3,890 planned park-and-ride spaces, which is the same as the L2: SR 99 Mixed Profile Light Rail Alternative.

For the B2: Multi-Corridor BRT Alternative, the pedestrian and bicycle accessibility rating (high) is approximately the same as for the TSM/Baseline Alternative. There are 72 existing bus routes at or near the 11 station areas that could provide connectivity to the B2: Multi Corridor BRT Alternative. This is approximately the same as the TSM/Baseline Alternative, and would result in a high rating for bus connectivity. The B2: Multi-Corridor BRT Alternative includes 4,190 park-and-ride spaces, 450 fewer than the TSM/Baseline Alternative and 300 to 400 more than the light rail alternatives.

5.2 LAND USE AND ECONOMIC DEVELOPMENT POTENTIAL

The land use and economic development evaluation builds on the Level 1 evaluation, and incorporates additional analyses that have been done to determine the extent to which current and planned land use along the candidate corridors and within station areas will support the proposed transit investments.

For the Level 2 evaluation, the following two categories were used to assess the land use and economic development potential of each alternative:

- **Land use and economic development compatibility** - a review of each alternative's consistency with VISION 2040 (PSRC 2009) and Regional Economic Strategy (PSRC 2005); and the types of existing land uses surrounding each station and alternative.
- **Transit-supportive land use** - a review of each alternative's ability to serve existing and future population, employment, and housing; proximity to a balanced mix of uses; station area character; level of connectivity to major trip generators; and existing development strategies near alternatives and stations.

The TSM/Baseline Alternative was not analyzed for development potential because it is not considered a build alternative and is used solely as a basis for comparison in the New Starts process. Station areas along the TSM/Baseline Alternative were included to present other associated analysis.

5.2.1 Key Findings

Key findings related to land use and economic development potential for the alternatives are described in the following section.

LAND USE AND ECONOMIC DEVELOPMENT COMPATIBILITY

Consistency with PSRC VISION 2040 and Regional Economic Strategy

The L1: I-5 Light Rail Alternative is the most consistent with regional planning strategies because it would serve the most riders and deliver the greatest travel time savings at both the regional and major activity center levels, consistent with the region's land use and economic vision that focuses growth into major regional centers such as Northgate and Lynnwood. The L3: SR 99 Elevated Light Rail Alternative also would serve many riders, but fewer than the L1: I-5 Light Rail Alternative; it also would have a longer travel time.

Existing Land Use Assessment

The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives have the most transit-compatible existing land uses within their station areas, due to the zoning and development patterns along SR 99.

TRANSIT SUPPORTIVE LAND USE

Population, Employment, and Housing

The bus alternatives, having a much higher number of bus stops and stations, have the highest totals, but their user benefits (i.e., travel time savings times number of riders) are minimal compared to the alternatives with shorter travel times, particularly the L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative. This indicates that even though there is more potential transit access to population and employment with the bus alternatives, less people use them due to the lower quality of service.

Balanced Mix of Uses

The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives would have the most balanced mix of uses surrounding their five stations. All five stations would be located in areas with commercial, mixed-use, and multi-family zoning destinations. The L1: I-5 Light Rail Alternative includes four stations, sharing two of the station locations with the other alternatives. The remaining two stations would be located along I-5 and adjacent to single-family neighborhoods. The B2: Multi Corridor BRT Alternative would be less balanced, primarily because it would serve many stations surrounded by a high proportion of single-family housing.

Existing Station Area Assessment

All alternatives were ranked medium or low on this measure. Traditional residential neighborhoods with local businesses rated the highest. Candidate station areas generally lack existing transit-oriented types of development.

Connectivity to Major Trip Generators

None of the alternatives performed well on this measure because of the primarily automobile-oriented commercial development in the project area. Even when walk distances are short, pedestrian access can be challenging due to the poor quality of and/or lack of sidewalks, continuous curb cuts, and other barriers.

Transit-Supportive Plans and Policies

The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives outperform the other alternatives. The B2: Multi-Corridor BRT Alternative performs well with "high" and "medium" station areas, but because it would have many more stations overall, it also has the highest number of "low" performing stations.

5.2.2 Land Use and Economic Development Compatibility

CONSISTENCY WITH PSRC VISION 2040 AND REGIONAL ECONOMIC STRATEGY

Each alternative's support for VISION 2040 was measured by three factors: consistency with existing corridor land uses; the number of projected daily riders; and the travel time between the corridor's two regional growth centers—Lynnwood and Northgate. All alternatives support VISION 2040 to varying degrees, but the L1: I-5 Light Rail Alternative is the most supportive. Table 5-12 summarizes the results.

Table 5-12. Summary of Consistency with PSRC VISION 2040 and Regional Economic Strategy

Alternative	Project Daily Riders	2030 Travel Time (minutes) between Lynnwood and Northgate*	Consistency with Existing Land Use	Consistency with PSRC VISION 2040 and Regional Economic Strategy
TSM/Baseline	21,000	30	Moderate, but low along 15th Avenue NE	Low
L1: I-5 Light Rail	52,000	14	Low	High
L2: SR 99 Mixed Profile Light Rail	41,000	21	High	Moderate
L3: SR 99 Elevated Light Rail	48,000	18	High	Moderate-High
B2: Multi-Corridor BRT	24,000	24	Moderate, but low along 15th Avenue NE	Low

*Travel time is in minutes in the 2030 Peak-Period Peak Direction of Flow

The TSM/Baseline Alternative is used as the baseline for the FTA New Starts process and the build alternatives, below, are compared to it.

The L1: I-5 Light Rail Alternative would provide the most support for VISION 2040 and the Regional Economic Strategy. It would connect two PSRC-designated Regional Growth Centers with the shortest travel time over the other alternatives, serve the most riders, and have significant capacity to absorb ridership growth.

The L2: SR 99 Mixed Profile Light Rail Alternative would provide moderate support for VISION 2040 and the Regional Economic Strategy. It would connect two PSRC-designated Regional Growth Centers, with a travel time 7 minutes longer than the L1: I-5 Light Rail Alternative, and serve more people than the TSM/Baseline Alternative or B2: Multi-Corridor Alternative, but far less than the L1: I-5 Light Rail Alternative. It also would have very limited capacity to absorb future travel growth.

The L3: SR 99 Elevated Light Rail Alternative would provide moderate to high support for VISION 2040 and the Regional Economic Strategy. It would connect two PSRC-designated Regional Growth Centers with a travel time 4 minutes longer than the L1: I-5 Light Rail Alternative, and serve more people than the TSM/Baseline Alternative or B2: Multi-Corridor Alternative, but slightly less than the L1: I-5 Light Rail Alternative.

The B2: Multi-Corridor BRT Alternative would provide the second lowest support for VISION 2040 and the Regional Economic Strategy. It would connect two PSRC-designated Regional Growth Centers but with fewer system riders and longer travel times than the light rail alternatives. It also would have virtually no capacity to absorb future travel growth.

EXISTING LAND USE ASSESSMENT

The analysis of existing land use was based on current zoning both along the corridor and within 0.50-mile radius around station and/or bus stop areas. GIS data were collected along the alignments and the local jurisdictions' land use designations were grouped into six general categories: single-family residential, multi-family residential, commercial (retail and business uses), institutional/public, mixed use, and parks and open space.

Table 5-13 summarizes the results of this analysis. The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives have the most transit-compatible existing land uses both along the alignment and within station areas. The more intense uses along SR 99 are concentrated close to the potential stations, transitioning to lower density residential uses toward the periphery, and therefore would provide the greatest compatibility close to the proposed stations. The two bus alternatives also would provide service along SR 99 and include station and bus stop improvements.

As shown by the existing zoning patterns illustrated in Figure 5-18, the greatest concentrations of commercial and mixed uses between Northgate and Lynnwood are located along SR 99.

Table 5-13. Summary of Land Use Compatibility by Alternative

Alternative	Consistency with Existing Land Use
TSM/Baseline	Moderate, but low along 15th Avenue NE
L1: I-5 Light Rail	Low, except near Lynnwood Transit Center
L2: SR 99 Mixed Profile Light Rail	High, except low to moderate along the connecting east/west links to Northgate on the south and Lynnwood on the north.
L3: SR 99 Elevated Light Rail	High, except low to moderate along the connecting east/west links to Northgate on the south and Lynnwood on the north.
B2: Multi-Corridor BRT	Moderate, but low along 15th Avenue NE

All alternatives would serve the Lynnwood Transit Center and Northgate, which are the regional growth centers anticipated to receive the highest percentage of future growth in the project area. In addition, all of the primary alternatives would serve the Mountlake Terrace Transit Center. Only the SR 99 North Variation of the L2: SR 99 Mixed Profile Light Rail Alternative would not serve this station.

Table 5-14 summarizes the differences in existing land uses along alternatives and around station areas for each alternative, not including the stations at Northgate, Mountlake Terrace and Lynnwood, which are common to all alternatives. The *Station Area Development Potential Technical Memorandum* (Sound Transit 2011g) provides more detail about land use for each station area.

Table 5-14. General Existing Land Use by Alternative

Alternative	General Existing Station Area Land Use (between Northgate and Mountlake Terrace only)
TSM/Baseline	SR 99: automobile-oriented, low-density strip commercial development with pockets of higher density residential and commercial uses and single-family residential in areas away from SR 99 I-5: predominantly single-family residential, with some institutional uses 15th Avenue NE: mix of single-family residential with hubs of greater intensity commercial and multi-family uses around arterial intersections
L1: I-5 Light Rail	Predominantly single-family residential, with some institutional uses
L2: SR 99 Mixed Profile Light Rail	Automobile-oriented, low-density strip of commercial development with pockets of higher density residential and commercial uses and single-family residential areas away from SR 99
L3: SR 99 Elevated Light Rail	Automobile-oriented, low-density strip of commercial development with pockets of higher density residential and commercial uses and single-family residential areas away from SR 99
B2: Multi-Corridor BRT	Three corridors generally the same as the TSM/Baseline Alternative

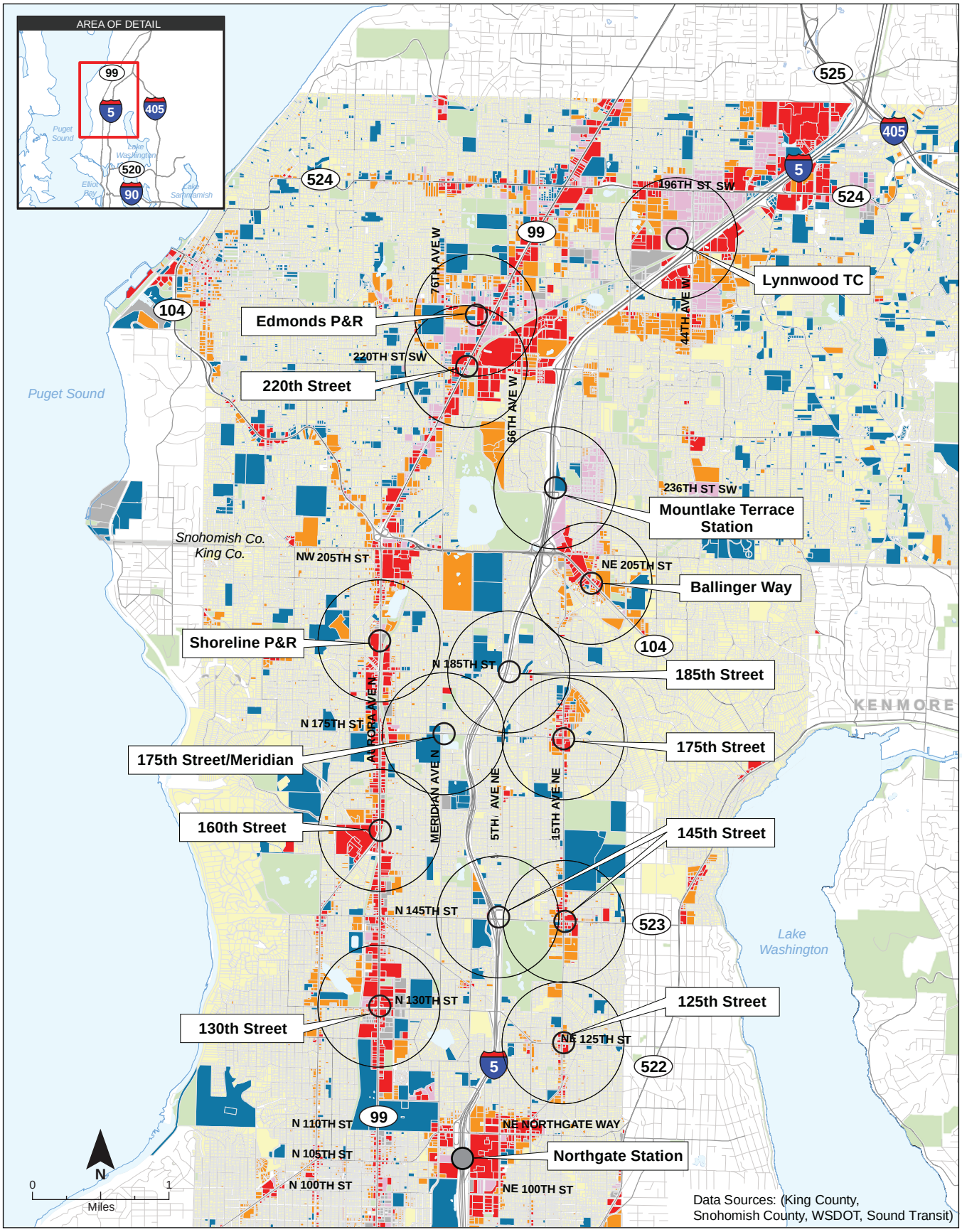


Figure 5-18. General Existing Land Uses

The L1: I-5 Light Rail Alternative primarily would run along I-5, a major interstate freeway that has the highest level of existing bus services in the study area. In this sense, it is highly compatible with the existing freeway land use; however, most of development adjacent to I-5 is single-family residential. Land uses around the I-5 station areas are predominantly single family with some institutional uses (public and private schools) at both the NE 145th and NE 185th Street station locations, and a golf course near NE 145th Street.

The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives run along SR 99, an expanded major regional arterial street which has the second highest level of existing bus service in the study area. Land uses in the SR 99 station areas are generally automobile-oriented, low density strip commercial development with pockets of higher density residential and commercial uses and single family residential in areas away from SR 99.

To the north, the primary L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives connect back to Lynnwood via SR 104, a major east-west arterial and state highway that passes through a mix of commercial uses at each end, but is predominantly mixed-density residential through most of this segment. The SR 99 North Variation continues along SR 99 into Snohomish County, with an additional station at 220th Street SW, and then continues east along 208th Street SW. Land uses in this segment are predominantly automobile-oriented commercial and retail, similar to the stretch of SR 99 to the south. The section along 208th Street SW runs along a residential arterial with a mix of multi-family and single-family residences.

To the south, the primary L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives connect back to Northgate along North 110th Street. Land uses along North 110th Street include a mix of commercial and residential uses as well as a cemetery. The Roosevelt Way Variation connects back to Northgate along Roosevelt Way, a narrow, minor residential collector street that passes through a predominantly single-family neighborhood. No stations would be located along these segments, and the Roosevelt Way Variation would bypass the North 130th Street Station contained in the primary SR 99 light rail alternatives.

The B2: Multi-Corridor BRT Alternative would operate along arterial and limited access roadways that have varying levels of existing bus services and serve bus stops and stations within existing road rights-of-way. One of the three BRT routes would use the I-5 HOV lanes and make no stops between Mountlake Terrace and Northgate. The second BRT route, SR 99, includes more intense activity nodes near the commercial and multi-family land uses at the Shoreline Town Center, between North 175th and North 185th Streets, and near North 160th and North 130th Streets. North of North 185th Street, land uses consist of typical commercial development of one or two stories, with ample surface parking. 15th Avenue NE is the third major route served, along which stop areas are surrounded by single family residential uses, with occasional hubs of commercial and multi-family areas around arterial intersections such as at Ballinger Way, NE 175th, NE 145th, and 125th Streets.

Land uses along the B2: Multi-Corridor BRT Alternative are similar to those described for the TSM/Baseline Alternative, with the addition of commercial and multi-family land uses near North 160th and 130th Streets on SR 99 and NE 145th and 125th Streets on 15th Avenue NE.

5.2.3 Transit-Supportive Land Use

Transit-supportive land use is characterized by a mixture of housing and employment within convenient walking distance of transit, and urban design features that support and encourage walking. This type of land use around transit stations is known to increase ridership and to help create and sustain vitality and livability in the surrounding areas.

FTA's Section 5309 New Starts criteria provide the most recent guidance for evaluating land use and economic development potential and are consistent with the discussion that follows.

POPULATION, EMPLOYMENT, AND HOUSING

Population, employment, and housing statistics are commonly used to evaluate land uses that support transit. The alternatives include station areas with the potential to serve both existing and future population and employment. Table 5-15 summarizes the existing and forecasted population, employment, and number of housing units within the defined station areas by alternative.

Table 5-15. Existing and Forecasted Station Area Population, Employment, and Housing

Alternative	No. of Station Areas	Population		Employment		Housing Units	
		Existing	2030	Existing	2030	Existing	2030
TSM/Baseline	9	34,000	38,500	18,600	23,400	14,500	16,400
L1: I-5 Light Rail	4	13,400	15,600	4,900	6,800	5,100	5,900
L2: SR 99 Mixed Profile Light Rail*	5	20,700	23,800	11,700	15,000	9,500	10,800
L3: SR 99 Elevated Light Rail	5	20,700	23,800	11,700	15,000	9,500	10,800
B2: Multi-Corridor BRT	10	43,900	50,900	23,200	29,700	20,000	23,200

*The SR 99 North Variation includes a station at 220th Street in Edmonds in place of the Mountlake Terrace Station. Population numbers are lower for this option and employment and housing numbers are higher. The Roosevelt Way Variation eliminates the North130th Street Station. Population, employment, and housing units each drop by over 25 percent.

Population, employment, and housing figures need to be considered together with user benefit—measured in this study in terms of hours of travel time savings. If people will not derive benefits (i.e., travel time savings) from using the transit system, they will not be attracted to it, and the ridership potential will not be realized. Details regarding transit user benefits by alternative are presented in Section 5.1 in terms of ridership, capacity, reliability, travel times, and overall travel time savings. Based on this information, the rail alternatives, particularly the

L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives, perform far better than the bus alternatives.

The B2: Multi-Corridor BRT Alternative would have 10 bus stations, which is twice as many as the light rail alternatives. This alternative also would have the highest total population, employment, and number of housing units. The I-5 and SR 99 light rail alternatives, serving four and five stations respectively, have lower numbers but would provide significantly increased user benefits in the form of greater travel time savings to a higher number of riders.

BALANCED MIX OF USES

A balanced mix of land uses near stations is supportive of transit use. A measure of the composition of land use patterns as a percentage of each designation under current zoning was used to assess this balance within a 0.50-mile radius of each station. Roadway and freeway right-of-way are included, while water features, primarily minor lakes, are excluded. Station areas with over 50 percent of one use were rated lower than those with a more balanced mix of uses. Positive attributes of a station area that resulted in a higher rating include specific mixed-use designations and commercial uses over 15 percent. Alternatives with a high percentage of rights of way were rated lower. The mix of uses measure is based on existing zoning designations and may not reflect what is built and on the ground today.

Figure 5-19 summarizes the results of this analysis by station and Table 5-16 summarizes the results of this analysis by alternative. The Lynnwood Transit Center Station (a PSRC designated Regional Growth Center included in all alternatives) and the North 130th Street Station have the strongest balance of zoned uses. Current land uses at Lynnwood Transit Center Station, however, do not reflect the balance allowed by zoning. The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives include two or three stations with the strongest balance of uses and no low-performing stations, as illustrated in Table 5-16.

Figure 5-19 illustrates the high percentage of single-family zoning for many of the station areas, as well as the high percentage of rights-of-way for most alternatives. Parks/open space and rights-of-way typically are not redeveloped, decreasing the likelihood for transit supportive uses within those station areas. Almost 50 percent of the Mountlake Terrace Freeway Station area is either parks/open space or rights-of-way; however, the housing and mixed-use zones contribute to a balance of uses.

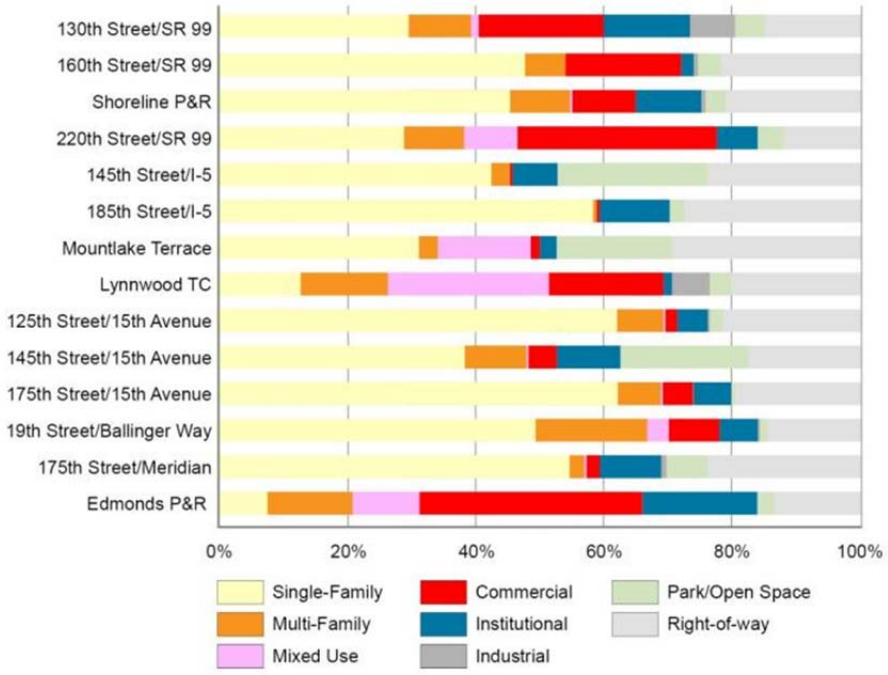


Figure 5-19. Zoned Mix of Uses by Station Area

Table 5-16. Summary of Balanced Mix of Uses by Alternative

Alternative	Station Area Ratings	Highly Rated Stations/ Total Stations
TSM/Baseline	High (2) Medium (2) Low (5)	2/9
L1: I-5 Light Rail	High (1) Medium (1) Low (2)	1/4
L2: SR 99 Mixed Profile Light Rail*	High (2) Medium (3)	2/5
L3: SR 99 Elevated Light Rail	High (2) Medium (3)	2/5
B2: Multi-Corridor BRT	High (3) Medium (4) Low (3)	3/10

* The SR 99 North Variation would replace one medium ranked station with a high ranked station. The Roosevelt Way Variation would result in four stations, one high rating, and three medium ratings, similar to L1.

The L1: I-5 Light Rail Alternative performs moderately well, with one highly-rated station at the Lynnwood Transit Center. Three of the station areas include I-5 where the percentage of rights-of-way is higher than with other alternatives.

The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives perform well, with all station areas having either a medium or high balanced mix of uses (as zoned). The SR 99 North Variation includes the 220th Street Station in place of the Mountlake Terrace Freeway Station, with a stronger mix of zoned uses. The Roosevelt Way Variation would not include the highly rated North 130th Street Station.

The B2: Multi-Corridor BRT Alternative performs moderately well overall. Station areas along SR 99 and the Mountlake Terrace Freeway Station have better mixes of zoned uses than do station areas along 15th Avenue NE, where single-family zones predominate.

EXISTING STATION AREA CHARACTER

The following attributes were considered to determine the existing character of a station area: well-proportioned facades; minimal building setbacks; street furniture, trees and other pedestrian amenities; barrier-free station access; and narrow roads that can be crossed easily with low-to-moderate traffic speeds. Results from station area assessments along each alternative are combined and compared across all alternatives.

None of the station areas was rated high for existing character. Although some stations would have an excellent block (street grid) size, they are rated medium or low due to other factors such as sidewalks, barriers, or type of roadway. Table 5-17 provides a summary of average ratings by alternative and Table 5-18 shows the character ratings by station area.

Table 5-17. Summary of Existing Station Area Character for Alternatives

Alternative	Average Character Rating	Number of Stations in Alternative
TSM/Baseline	Medium - Low	9 stations
L1: I-5 Light Rail	Low	4 stations
L2: SR 99 Mixed Profile Light Rail*	Medium - Low	5 stations
L3: SR 99 Elevated Light Rail	Medium - Low	5 stations
B2: Multi-Corridor BRT	Medium - Low	10 stations

*The SR 99 North Variation and Roosevelt Way Variation would see no significant change in character rating.

In general, stations along the I-5 corridor rate the lowest, stations along the SR 99 corridor have moderate ratings, and stations along 15th Avenue NE perform best. Smaller block sizes and fewer automobile-oriented businesses on 15th Avenue NE create a better character. However, in the residential areas, there is less of the retail and service activity that can enhance the livability of an area. Station areas along SR 99 have the zoning in place to support businesses, but the quality of the existing character is poor, with "big box" retail and expansive parking lots fronting streets.

Table 5-18. Existing Station Area Character Rating

Station Areas	TSM/ Baseline Alternative	L1: I-5 Light Rail	L2: SR 99 Mixed Profile Light Rail*	L3: SR 99 Elevated Light Rail	B2: Multi-Corridor BRT
130th Street			Medium	Medium	Medium
160th Street			Low	Low	Low
Shoreline Park-and-Ride	Medium		Medium	Medium	Medium
220th Street	Low				Low
145th Street	Low	Low			
185th Street		Low			
Mountlake Terrace Freeway Station	Medium	Medium	Medium	Medium	Medium
Lynnwood Transit Center	Low	Low	Low	Low	Low
125th Street					Medium
145th Street/15th Avenue NE					Medium
175th Street	Medium				Medium
Ballinger Way	Low				Low
175th Street/Meridian	Medium				
Edmonds Park-and-Ride	Low				

*The SR 99 North Variation includes the 220th Street (rated low) in place of the Mountlake Terrace Freeway Station (rated medium). Roosevelt Way Variation eliminates the North130th Street Station (rated high).

CONNECTIVITY TO MAJOR TRIP GENERATORS (ACTIVITY CENTERS)

A qualitative analysis was completed to determine the level of connectivity between each activity center and its nearest station based on distance, availability of sidewalks, adjacent land uses, and general quality of the walk. Activity centers designated using published data on activity centers within the project area were collected, compared with FTA and PSRC guidance, and confirmed in consultation with local jurisdictions. In calculating walk distances, if an activity center is a district or larger shopping area, the distance was measured to the center of the district. Transit service accessibility, evaluated in Section 5.1.7, was reviewed and, where appropriate, included in this assessment. Results from station area assessments along each alternative were combined and compared across all alternatives.

Twenty-five activity centers were identified, 15 of which are located within a 0.50-mile radius of station locations. The walk path between each activity center and the nearest station was

determined, and in some cases it was significantly longer than 0.50 mile due to street grid, topography, and other barriers. Table 5-19 summarizes the rating for connectivity by alternatives. Figure 5-20 illustrates the locations of defined activity centers and Table 5-20 includes rating by activity center.

Most of the designated activity centers are located along the SR 99 corridor and range from larger "districts" of multiple blocks to a single site. The B2: Multi Corridor BRT Alternative serves the highest number of activity centers. Because this alternative includes transit service in three different corridors, the high number of centers served provides broad coverage of the large size of the service area.

Connections to the smaller business districts at North City and Mountlake Terrace received the highest rating, in part due to the proximity of the activity center to the station but also due to the existence of sidewalks, minimal large driveways to cross, and general community character.

The connection to the proposed Lynnwood City Center received a low rating. The heart of the proposed city center is approximately 0.5 mile from the Lynnwood Transit Center Station, but the existing walk path is next to parking lots with multiple driveways.

Table 5-19. Summary of Connectivity to Activity Centers within Station Areas for Alternatives

Alternative	Activity Centers	Average Walk Rating	Number of Stations in Alternative
TSM/Baseline	14	Medium	9 stations
L1: I-5 Light Rail	7	Medium - Low	4 stations
L2: SR 99 Mixed Profile Light Rail*	8	Medium	5 stations
L3: SR 99 Elevated Light Rail	8	Medium	5 stations
B2: Multi-Corridor BRT	14	Medium	10 stations

*The SR 99 North Variation has nine activity centers and the average walk rating would be medium. The Roosevelt Way Variation has seven activity centers, four stations, and the average walk rating would not change.

Table 5-20. Walk Rating by Activity Center

Map Number	Activity Center	Station	Walk Rating
5	Bitter Lake Hub Urban Village	130th Street (SR 99)	Medium
6	Commercial area at 15th and 145th	145th Street (15th Avenue NE)	High
6	Commercial area at 15th and 145th	145th Street (I-5)	Low
7	Shoreline Community College	160th Street (SR 99)	Medium
8	Aurora Square Shopping Center	160th Street (SR 99)	Medium
9	Shoreline Town Center	175th Street (Meridian)	Medium
10	Aurora Village Shopping Center	Shoreline Park-and-Ride	Low
11	North City Business District	175th Street (15th Avenue NE)	High
11	North City Business District	185th Street (I-5)	Low
12	Shoreline Conference Center	185th Street (I-5)	Medium
13	Ballinger Terrace	Ballinger Way (19th Avenue NE)	Medium
13	Ballinger Terrace	Mountlake Terrace	Low
16	International District	220th Street (SR 99)	Medium
17	Hospital Community and Family Retail Center	220th Street (SR 99)	Medium
17	Hospital Community and Family Retail Center	Edmonds Park-and-Ride	Low
18	Mountlake Terrace Town Center	Mountlake Terrace	High
19	Melody Hill Premera	220th Street (SR 99)	Medium
19	Melody Hill Premera	Edmonds Park-and-Ride	Low
20	Lynnwood City Center	Lynnwood Transit Center	Low
23	Group Health	Lynnwood Transit Center	Medium

The SR 99 North Variation has three activity centers not listed above, all rated medium. Two activity centers would not be included in this variation, one rated low and one rated medium.

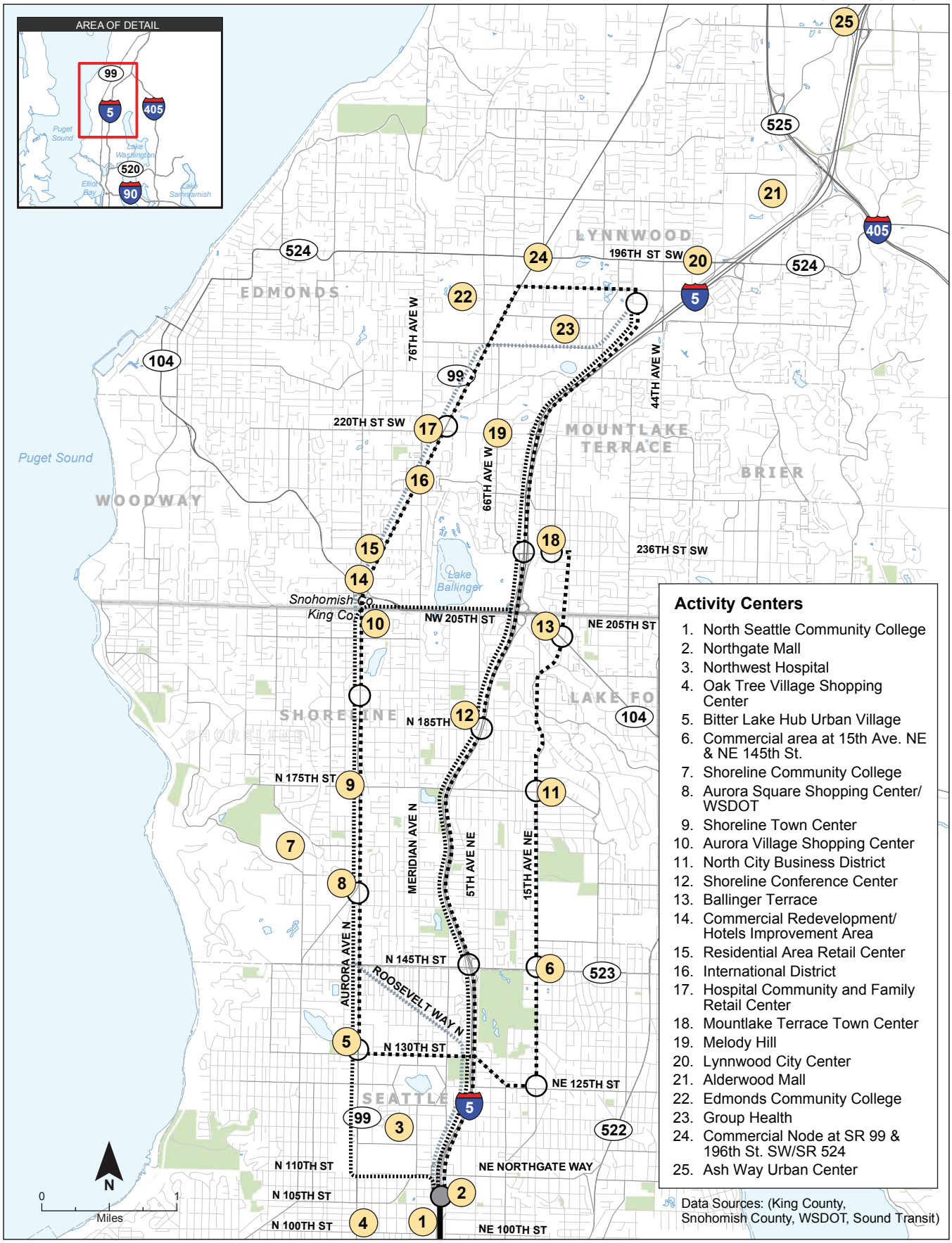


Figure 5-20. Activity Centers

TRANSIT-SUPPORTIVE PLANS AND POLICIES

This measure includes a qualitative discussion of existing development strategies for station areas including transit-supportive plans, policies that support and promote transit-oriented growth in station areas, and existing programs and incentives that facilitate growth around transit stations. Results for each station area are combined by alternative. The TSM/Baseline Alternative was not analyzed for development potential, because it is not considered a build alternative and is used solely as the FTA New Starts baseline.

Adopted plans and policies were reviewed to evaluate how each station and alternative could support transit-oriented development and associated future land-use densities. The reviewed plans and policies included comprehensive plans, land use and zoning documents, sub-area plans, and other transit-related plans and policies. A complete listing of reviewed documents is included in the Station Area Development Potential Technical Memorandum (Sound Transit 2011g).

Information for station areas was combined for each alternative and results were compared across all alternatives. Some station areas would be served by light rail or BRT, depending on the selected alternative, and the analysis was consistent for either mode. Table 5-21 provides a summary by alternative and Table 5-22 illustrates development potential by station.

Table 5-21. Transit-Supportive Plans and Policies by Alternative

Alternative	Ratings (per each station area)	Percent of Medium or Highly Rated Stations
L1: I-5 Light Rail	High (1) Medium (1) Low (2)	50%
L2: SR 99 Mixed Profile Light Rail*	High (2) Medium (3)	100%
L3: SR 99 Elevated Light Rail	High (2) Medium (3)	100%
B2: Multi-Corridor BRT	High (2) Medium (4) Low (4)	60%

*The SR 99 North Variation includes a station at 220th Street (medium rating) that would replace the Mountlake Terrace Freeway Station (medium rating). The Roosevelt Way Variation eliminates one highly rated station.

Table 5-22. Transit-Supportive Plans and Policies by Stations

Station Areas	L1: I-5 Light Rail	L2: SR 99 Mixed Profile Light Rail	L3: SR 99 Elevated Light Rail	B2: Multi-Corridor BRT
130th Street		High	High	High
160th Street		Medium	Medium	Medium
Shoreline Park-and-Ride		Medium	Medium	Medium
220th Street				Medium
145th Street	Low			
185th Street	Low			
Mountlake Terrace Freeway Station	Medium	Medium	Medium	Medium
Lynnwood Transit Center	High	High	High	High
125th Street				Low
145th Street/ 15th Avenue NE				Low
175th Street				Low
Ballinger Way				Low
175th Street/ Meridian				
Edmonds Park-and-Ride				

The L1: I-5 Light Rail Alternative has an overall medium level of support for transit-oriented development around stations, as summarized below by jurisdiction.

- **Lynnwood:** The City of Lynnwood developed and adopted a City Center sub-area Plan focused on a mixed-use, pedestrian-friendly and transit supportive center near the Lynnwood Transit Center. The sub-area Plan outlines policies to accommodate city center growth including mixed-use development in buildings ranging in height from 140 to 350 feet. Lynnwood has also developed City Center Design Guidelines, a Street Master Plan with a smaller street grid in the City Center, and a Parks Master Plan.

  Other activities include a Market Analysis and Absorption Study; an 8- to 12-year multi family property tax exemption to exempt apartment and condominium developments within the City Center; planned creation of a Business Improvement District; phased consolidation of City facilities; and development of property acquisition strategies.

- **Mountlake Terrace:** The City's Comprehensive Plan provides for the development of a revitalized town center within a 5-minute walk of the Mountlake Terrace Freeway

Station. The City designated a Community Business Downtown zone with transit- and pedestrian oriented policies. A Transit Oriented Development Study focuses on the town center area, with recommendations incorporated into the Comprehensive Plan and related town center planning efforts.

A Transit Service Strategy focuses on the town center and the North Melody Hill area, and supports transit-oriented development at the Mountlake Terrace Freeway Station area to provide better transit access to the North Melody Hill area.

An updated Freeway/Tourist zoning designation would allow 20-story buildings just south of the Mountlake Terrace Freeway Station.

- **Shoreline and Seattle:** There are no existing transit-supportive plans and policies for station areas along I-5 at 185th Street or 145th in the cities of Shoreline and Seattle.

The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives have an overall high level of support for transit-oriented development around stations, as summarized below by jurisdiction.

- **Lynnwood:** Similar to the L1: I-5 Light Rail Alternative.
- **Mountlake Terrace:** Similar to the L1: I-5 Light Rail Alternative. The SR 99 North Variation does not include a Mountlake Terrace Freeway Station, but includes a station along SR 99 at 220th Street, which would serve Stevens Hospital, part of an envisioned Hospital Community and Family Retail Center. This station would be located 0.50 mile from a major employer, Premera, in the North Melody Hill area of Mountlake Terrace. The Mountlake Terrace Transit Strategy includes North Melody Hill as a critical service area without addressing efforts to affect land use change.
- **Shoreline:** Shoreline would have two stations under this alternative. The City of Shoreline does not have specific adopted transit-oriented plans or policies around either station area, but King County has identified the Shoreline Park-and-Ride site as an excellent candidate for transit-oriented development and plans to develop the site in the future. Supporting this, the City of Shoreline's economic development plans include this site as a priority for redevelopment.

  Shoreline's Comprehensive Plan includes a vision for SR 99 as "Shoreline's Grand Boulevard," Most of the improvements along this corridor have been completed, including BAT lanes that have transformed SR 99 into a street more conducive to transit activities. The plan also envisions high-density mixed-use housing along transit lines.

- **Seattle:** One station along this alternative would be located in Seattle at North 130th Street in the heart of a designated hub urban village. Bitter Lake Hub Urban Village's vision includes development of a residential-serving business zone in addition to continued commercial development along SR 99. The existing zoning supports transit-oriented development and mixed uses. The Bicycle Master Plan recommends bike

lanes on 130th Street and SR 99 north of 130th Street, encouraging non-motorized access to the area.

The Roosevelt Way Variation would eliminate the 130th Street Station, resulting in no stations in Seattle.

The B2: Multi-Corridor BRT Alternative has an overall moderate level of support for transit-oriented development around stations, as summarized below by jurisdiction.

- **Lynnwood:** Similar to the L1: I-5 Light Rail Alternative.
- **Mountlake Terrace:** Similar to the L1: I-5 Light Rail Alternative and the SR 99 North Variation.
- **Edmonds:** Similar to the SR 99 North Variation.
- **Shoreline:** Similar to the L1: I-5 Light Rail Alternative and L2: SR 99 Mixed Profile Light Rail Alternative with the addition of three stations in the 15th Avenue NE corridor from Ballinger Way to the southern city boundary. There is a tax exemption for multi-family developments in the North City business district area with the goal of adding more people to support the existing business district.
- **Seattle:** Similar to the L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives with the following addition: the City of Seattle does not have transit-supportive plans and policies for the station area at 15th Avenue NE and 125th NE Street.

5.3 ENVIRONMENTAL PERFORMANCE

5.3.1 Key Findings

Key findings related to environmental performance for the alternatives are described in the following section.

ECOSYSTEMS

All of the light rail alternatives have the potential for a high level of impacts on the natural environment because they cross sensitive wetland-stream complexes, including a wetland and stream area (Scriber Creek Wetland Complex) just south of the Lynnwood Station. If any of the light rail alternatives are selected, the project would explore design or alignment alternatives to avoid or minimize impacts to this wetland complex, which could affect the Lynnwood Station layout and orientation. The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives have longer routes but would encounter fewer natural areas than the L1: I-5 Light Rail Alternative and could affect sensitive areas to a lesser degree. The B2: Multi-Corridor BRT Alternative would have limited effects on the natural environment, as would the TSM/Baseline Alternative.

WATER RESOURCES

The L1: I-5 Light Rail Alternative would have a larger increase in impervious surfaces because its alignment is generally in vegetated areas along I-5. The L2 and L3 SR 99 light rail alternatives would have more sections in areas that are already developed. The B2: Multi Corridor BRT Alternative would have a lower level of effects, and only minor effects are expected with the TSM/Baseline Alternative.

SECTION 4(F) AND SECTION 6(F) RESOURCES

While all of the light rail alternatives have the potential for low to moderate impacts on Section 4(f) and Section 6(f) resources, the L1: I-5 Light Rail Alternative has the most potential for direct effects on historic resources or parks and recreation facilities that may qualify to be Section 4(f) resources, followed closely by the L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives. The TSM/Baseline and B2: Multi-Corridor BRT Alternatives have little to no potential for direct effects on Section 4(f) properties. No parks or recreation facilities that may qualify as Section 6(f) resources would likely be directly affected by any of the build alternatives.

HISTORIC RESOURCES

No properties listed in the National Register of Historic Places (NRHP) or designated as landmarks by affected jurisdictions have been identified in the area within one block of the project alternatives. However, all alternatives are in areas where historic era properties (50 years or older) are located. The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives could affect one property in the city of Shoreline that may be eligible for listing in the NRHP. These alternatives are also located along the SR 99 corridor, which has a large number of historic-era properties, although many have been altered and may not be NRHP eligible. Determination of the potential impacts for all alternatives would depend on more detailed design information, including right-of-way needs. Any of the project alternatives could affect potentially eligible properties. Further study during an EIS would be needed to identify other properties along the corridor that may be eligible for listing in the NRHP.

ARCHAEOLOGICAL RESOURCES

No known archaeological sites would be affected by the project alternatives, but further evaluation and consultation with the Washington State Department of Archaeology and Historic Preservation (DAHP), tribes, and others would be conducted in the EIS.

AIR QUALITY AND GREENHOUSE GAS EMISSIONS

Most of the project alternatives have the potential to reduce air pollutant and greenhouse gas emissions, based on how well they help reduce automobile use compared to No Build conditions. The L1: I-5 Light Rail Alternative and the L3: SR 99 Elevated Light Rail Alternative would result in the greatest reduction in air pollutants and greenhouse gas emissions.

AESTHETICS

The L1: I-5 Light Rail, L2: SR 99 Mixed Profile Light Rail, and L3: SR 99 Elevated Light Rail Alternatives include more elements that would result in changes to visual character in the corridor. This includes the removal of existing visual features and the construction of elevated guideways and multi-story park-and-rides. Much of this construction would be along established transportation corridors. The TSM/Baseline and B2: Multi-Corridor BRT Alternatives generally would limit changes to station development areas or direct access ramps.

NOISE

All of the light rail alternatives have alignments near noise-sensitive land uses, including single-family residences, hotels, motels, and apartment buildings. The B2: Multi-Corridor BRT and TSM/Baseline Alternatives would result in lower noise effects than the light rail alternatives, as they would require fewer changes to the existing noise environment.

PROPERTY ACQUISITIONS AND DISPLACEMENTS

All of the alternatives would require new right-of-way, which would affect properties owned by others. The L2: SR 99 Mixed Profile Light Rail Alternative and its two route variations would require the most right-of-way, requiring about 44 acres of new right-of-way and impacting 320 to 370 parcels. This would be nearly double the effects compared to the L1: I-5 Light Rail Alternative, which would need about 22 acres for new transportation right-of-way, affecting 140 to 270 parcels. The L3: SR 99 Elevated Light Rail Alternative would require a similar but slightly lower amount of new right-of-way than the L2: SR 99 Mixed Profile Light Rail Alternative. The B2: Multi-Corridor BRT and TSM/Baseline Alternatives would have few right-of-way impacts.

TRANSPORTATION

General Purpose Traffic Operations

The highest level of impact on general purpose traffic operations (arterial and local traffic) would occur with the L2: SR 99 Mixed Profile Light Rail Alternative. Effects on intersection operation could be mitigated with widening at intersections to provide replacement left-turn lanes. Median alignment of light rail, whether at-grade or elevated, would require reconstruction of the arterial with additional widening for left-turn storage to maintain intersection LOS, with longer delays to left-turn movements from SR 99 and to side street traffic. Median alignment would also result in access control for driveways and side streets between signals. Left turns previously made mid-block, as well as left-turn movements from the side streets, would be consolidated at signalized intersections and accommodated by U turns.

Transit Operations

The primary effect on transit operations would occur when bus routes are truncated to serve light rail alternatives, particularly the L1: I-5 Light Rail Alternative and the L3: SR 99 Elevated Light Rail Alternative, which each would experience a greater amount of bus route truncation than the L2: SR 99 Mixed Profile Light Rail Alternative. These alternatives are also projected to result in an increase in bus ridership for routes serving light rail, which would be accommodated

by changes in service. While light rail on either the I-5 or SR 99 corridor would affect ridership on King County Metro's RapidRide BRT and Community Transit's *Swift* BRT lines operating along SR 99, the SR 99 light rail alternatives would more directly connect to and compete with those services. Metro's RapidRide E line could experience lower ridership as some riders choose instead to use light rail along SR 99, while Community Transit's *Swift* line could see increased ridership prompted by a direct connection to light rail in Shoreline not provided by light rail running along I-5.

Transportation Safety

The L2: SR 99 Mixed Profile Light Rail Alternative would increase the potential for vehicle conflicts with regional transit; however, because the median alignment would provide more controlled traffic access—particularly at mid-block locations—some types of vehicle collisions may be reduced, e.g., those involving mid-block left-turning vehicles.

Construction

The L2: SR 99 Mixed Profile Light Rail Alternative is expected to have the highest level of traffic disruption over the longest duration (6 years) of all the alternatives because major reconstruction of SR 99 would need to occur in order to place light rail transit in the median. However, the L3: SR 99 Elevated Light Rail Alternative would also require major construction along SR 99, which has already been subject to major reconstruction in several of the sections that would be affected. All the light rail alternatives would also require structures over I-5, which would require freeway closures, but the SR 99 alternatives would involve more crossings with closures than the L1: I-5 Light Rail Alternative.

5.3.2 Ecosystems

For the purpose of this study, the ecosystems measures assess resources such as wetlands and jurisdictional ditches, fish, wildlife, and sensitive species. Wetlands and streams are subject to regulations by local jurisdictions, which include establishing buffers for wetlands and streams. Wetlands, streams, and sensitive species are also subject to federal and state regulations. At the federal level, wetlands and streams are regulated by the Clean Water Act (CWA) Section 404, which regulates placement of fill in waters of the United States. Activities that affect wetlands and streams may also require a water quality certification (Section 401 of the CWA). "Jurisdictional ditches" are waters that are not subject to federal regulation but are frequently considered as part of a wetlands impact assessment.

Fish and wildlife species are regulated at both state and federal levels. The U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) regulate listed species under the Endangered Species Act (ESA); Washington Department of Fish and Wildlife (WDFW) regulates state-listed species.

Because the No Build Alternative and TSM/Baseline Alternative involve few new facilities, they would be unlikely to affect or would have minimal effects on ecosystems in the project area.

The L1: I-5 Light Rail Alternative has the potential for affecting the natural environment, primarily due to the presence of moderate- to high-quality wetland-stream complexes along the corridor. However, potential effects on listed species are minimal. The L1: I-5 Light Rail Alternative would affect Thornton Creek and its associated wetlands, McAleer Creek and its associated wetlands, and Scriber Creek and its associated wetlands (see Figure 5-21). Just south of the Lynnwood Station area, the alternative has two approaches for crossing Scriber Creek and its wetlands. The option that stays along I-5 before crossing to a north/south oriented station in Lynnwood avoids more of the creek and wetland area, compared to an alignment that curves through a larger area of the creek and wetland to reach an east-west oriented station.

The L2: SR 99 Mixed Profile Light Rail Alternative also has the potential for natural environmental effects, but potential effects on listed species are minimal. It shares the same alignment as the L1: I-5 Light Rail Alternative in the areas near moderate- to high-quality wetland-stream complexes along the corridor, although it avoids Thornton Creek. It also crosses near McAleer Creek and its associated wetlands, near the Mountlake Terrace Station, but it has a different alignment than the L1: I-5 Light Rail Alternative in that area. From Mountlake Terrace Station to the north, it would have the same effects as the L1: I-5 Light Rail Alternative, including the potential for effects on Scriber Creek near the Lynnwood Station. Although the L2: SR 99 Mixed Profile Light Rail Alternative has more construction because it has a longer route, the additional area of construction would be mostly within previously developed areas with fewer natural areas.

The SR 99 North Variation could avoid effects on McAleer Creek and its associated wetlands, but it would have the same effects on the Scriber Creek wetland complex as the L2: SR 99 Mixed Profile Light Rail Alternative. The Roosevelt Way Variation would have the same impacts as the L2: SR 99 Mixed Profile Light Rail Alternative.

The L3: SR 99 Elevated Light Rail Alternative would have similar potential effects to those of the L2: SR 99 Mixed Profile Light Rail Alternative.

The B2: Multi-Corridor BRT Alternative may affect wetlands around I-5 near the Northgate Transit Center for the construction of direct access ramps to I-5.

The most sensitive areas along the alignment appear to be McAleer Creek and Scriber Creek and their moderate- or high-quality wetlands. The L1: I-5 Light Rail, the L2: SR 99 Mixed Profile Light Rail, and the L3: SR 99 Elevated Light Rail Alternatives cross the Scriber Creek wetland complex. If the L1: I-5 Light Rail, the L2: SR 99 Mixed Profile Light Rail, or L3: SR 99 Elevated Light Rail Alternatives are selected, the project would explore design or alignment alternatives to avoid or minimize impacts to this wetland complex, which could affect the Lynnwood Station layout and orientation. If impacts cannot be avoided, the project would provide mitigation measures, which would include the creation or restoration of wetlands to replace the lost function of the affected wetlands.

5.3.3 Water Resources

The project area lies entirely within Water Resource Inventory Area (WRIA) 8, and surface water runoff drains to Thornton Creek, Hall Creek/Ballinger Lake/McAleer Creek, and Scriber Creek (see

Figure 5-21). The project area receiving waters are highly urbanized, although fish bearing, and most have 100-year Federal Emergency Management Agency (FEMA) floodplains in the project vicinity. Lake Ballinger is the only project area waterbody included on the Washington State Department of Ecology (Ecology) 303(d) list of impaired waterbodies. Most major roads with stream crossings in the project area present fish-passage barriers. No major stormwater management facilities such as regional detention facilities are near the potential alignments. Surface water in the project area is generally conveyed in piped systems, with some roadside ditches. For areas that may discharge to combined sewer systems, capacity issues may exist. Most of the project area is developed and has a moderate-to-high amount of impervious surface.

There would likely be minimal to no effects for the No Build Alternative and TSM/Baseline Alternative because they would change very little of the existing land cover.

The L1: I-5 Light Rail Alternative would convert some vegetated areas with light rail and station area developments, potentially affecting nearby floodplains with receiving waters in the project area. This alternative would also result in the largest increase in impervious surface of all the proposed alternatives, and detention would potentially be required to reduce the risk of flooding from overloading the capacity of the local conveyance system. The L1: I-5 Light Rail Alternative would cross Thornton Creek and McAleer Creek, both of which currently have fish barrier culvert crossings at I-5. In areas where the alternative could alter WSDOT facilities or increase paved areas, improvements to WSDOT or local stormwater systems may also be needed.

The L2: SR 99 Mixed Profile Light Rail Alternative would have a lower risk of directly affecting receiving waters because there are fewer receiving waters within the proposed project area. This alternative would potentially affect a City of Seattle flood area in the south part of the alignment, Lake Ballinger in the north, and various stormwater ponds in between. North of Mountlake Terrace, the alternative would be similar to the L1: Light Rail Alternative, where much of the area to be developed would be within WSDOT right of way. The southern portion of area for the L2: SR 99 Mixed Profile Light Rail Alternative is already the most highly developed; therefore, this alternative would result in relatively minor increases to impervious surface. Construction to today's stormwater standards has the potential to reduce pollution-generating impervious surface. However, this alternative would likely require the most replacement and retrofit of existing storm drainage facilities.

The SR 99 North Variation would have similar effects to those of the L2: SR 99 Mixed Profile Light Rail Alternative; however, it would avoid effects to Lake Ballinger and some stormwater ponds, while posing a risk to others. Also, this variation would place retained fill in the vicinity of Hall Creek and its associated floodplain. The Roosevelt Way Variation would also have similar effects to those of the L2: SR 99 Mixed Profile Light Rail Alternative, although it would avoid effects to the City of Seattle flood area. The Roosevelt Way Variation would have a greater potential to increase impervious surface compared to the other alignment in the L2: SR 99 Mixed Profile Light Rail Alternative.

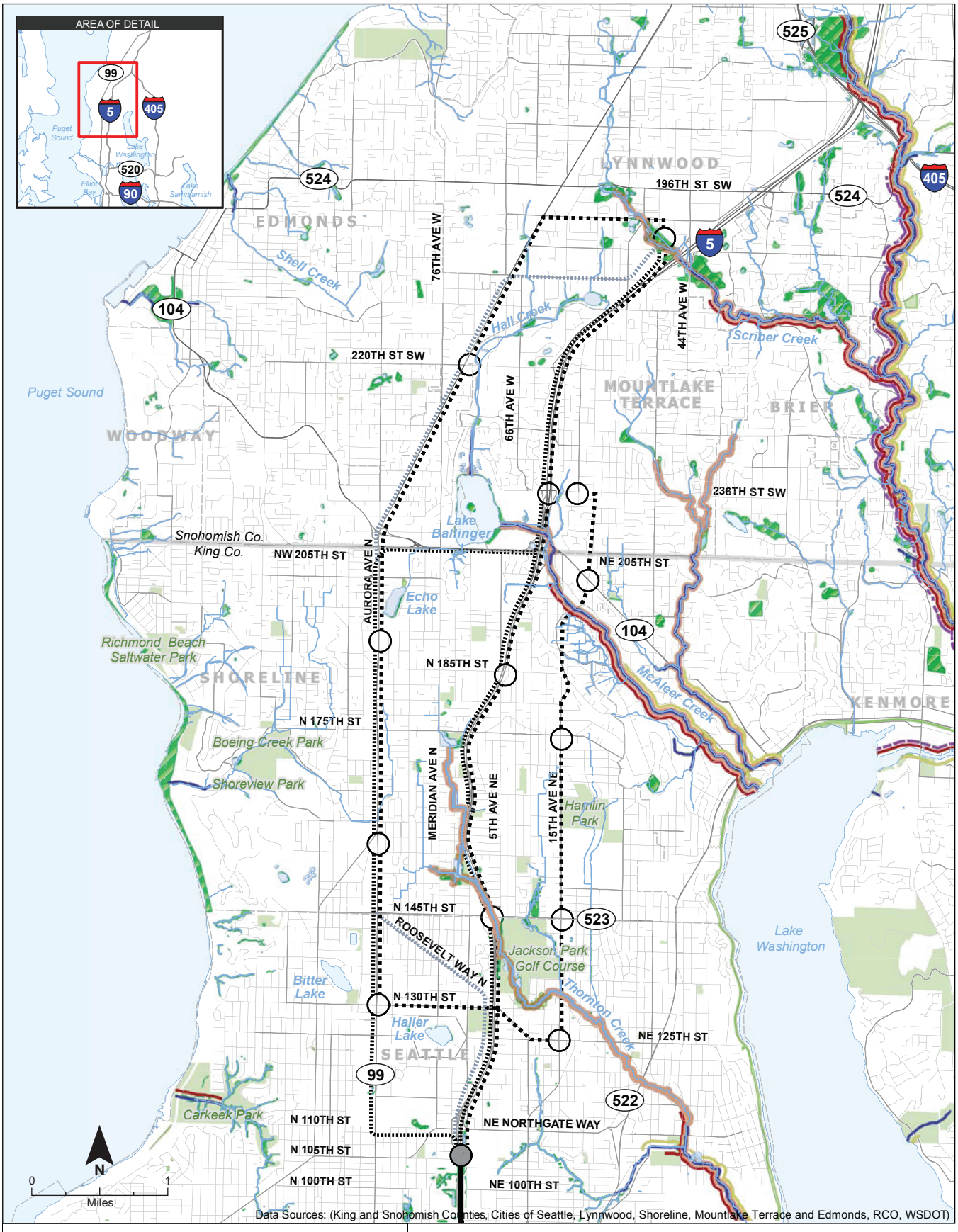


Figure 5-21. Ecosystems

The L3: SR 99 Elevated Light Rail Alternative would have similar effects to those of the primary L2: SR 99 Mixed Profile Light Rail Alternative.

The B2: Multi-Corridor BRT Alternative would have few effects on water resources except for minor increases in impervious surface.

5.3.4 Section 4(f) and Section 6(f) Resources

Section 4(f) is a U.S. Department of Transportation (USDOT) regulation that provides protections for publicly owned parks or recreation areas, wildlife and waterfowl refuges, Wild and Scenic Rivers, or any significant historic site. The regulation restricts the "use" of the resource by a transportation project. A use can include the conversion of land or other physical or environmental effects that adversely affect or substantially impair the qualities that make the resource eligible for Section 4(f) protection. There are some exceptions that can allow temporary, minor or de minimis effects, but in general the regulation requires transportation projects to avoid a use unless there are no other feasible and prudent alternatives available.

Section 6(f) resources are parks and recreation facilities that have been acquired or developed using Land and Water Conservation Fund (LWCF) grant money; if a project converts part of a Section 6(f) property to other uses, there are special requirements for how the conversion is evaluated and mitigated.

The sections below address Section 4(f) resources that may occur in the project area in two groupings. The first grouping focuses on parks and recreation resources, including resources that may qualify to be Section 4(f) resources, and the second focuses on historic resources that qualify as Section 4(f) resources.

PARKS AND RECREATION AREAS, INCLUDING SECTION 4(F) AND SECTION 6(F) PROPERTIES

Table 5-23 and Figure 5-22 show parks and recreation areas, including Section 4(f) and Section 6(f) properties, located within 0.25 mile of the four build alternatives. Table 5-23 shows the number of properties with the potential for direct effects due to potential acquisitions or alterations of the resources. These determinations are preliminary, which reflect the early stage of design information available and the proximity of alternatives to the resources. For Section 6(f) resources (parks and recreation facilities that were acquired or developed using LWCF grant money), a project would have an effect on a 6(f) property if some or all of the 6(f) property needed to be acquired for use by the project.

Table 5-23. Sections 4(f) and 6(f) Properties within 0.25 Mile of the Four Build Alternative Alignments

Alternative	Parks and Recreation Facilities-Section 4(f)		LWCF Properties-Section 6(f)	
	No. of Facilities within 0.25 Mile of Alignment	No. of Facilities with Potential for Direct Effects	No. of Properties within 0.25 Mile of Alignment	No. of Properties with Potential for Direct Effects
TSM/Baseline	7	1	0	0
L1: I-5 Light Rail	15	5	3	0
L2: SR 99 Mixed Profile Light Rail	14	4	3	0
L3: SR 99 Elevated Light Rail	14	3	3	0
B2: Multi-Corridor BRT	7	1	0	0

Parks and Recreation Facilities with Potential for Direct Effect

TSM/Baseline Alternative

- **Ronald Bog Park (ID#22)**—Expanded parking and minor roadway widening could encroach on this City of Shoreline park.

L1: I-5 Light Rail Alternative

- **Ridgecrest Park (ID#14)**—The alignment encroaches on the edge of this City of Shoreline park, placing light rail facilities near a ball field.
- **Veterans Memorial Park (ID#34)**—The alignment would be adjacent to this Mountlake Terrace park.
- **Shoreline Conference Center Recreation Areas (ID#24)**—The alternative would develop a multi-story park-and-ride on Shoreline Conference Center parking areas, adjacent to an athletic field. The property is owned by the Shoreline School District, but the recreation facilities are generally open to the public.
- **Scriber Creek Park (ID#39)**—One option to reach the Lynnwood Station alignment would cross a forested corner of this City of Lynnwood park, and would also remove forested and wetland areas bordering the park. Another option (related to a north/south station orientation) would avoid the park impact.
- **The Interurban Trail (shown as blue line in Figure 5-22), Lynnwood**—The alignment would cross over this regional multi-use trail, developed by the City of Lynnwood on right-of-way owned by the Snohomish County Public Utilities District.

L2: SR 99 Mixed Profile and L3: SR 99 Elevated Light Rail Alternatives

- **Shoreline Interurban Trail (shown as blue line in Figure 5-22), Shoreline**—The L2: SR 99 Mixed Profile Alternative would require the reconstruction of a bridge

overcrossing for this regional multi-use trail. The L3: SR 99 Elevated Light Rail Alternative would avoid replacing the bridge overcrossing but could affect ramps to the overcrossing.

- **Veteran's Memorial Park (ID#34)**—Same potential effects as for the L1: I-5 Light Rail Alternative.
- **Scriber Creek Park (ID#39)**—Same potential effects as for the L1: I-5 Light Rail Alternative.
- **The Interurban Trail (shown as blue line in Figure 5-22), Lynnwood**—Same potential effects as for the L1: I-5 Light Rail Alternative.

B2: Multi-Corridor BRT Alternative

- **North Acres Park (ID#4)**—Minor roadway widening and ramp realignment could encroach on this City of Seattle park.

Section 6(f)-LWCF Properties with Potential for Direct Effect

No parks or recreation facilities that used LWCF grant money for development or acquisition have the potential to be directly affected by any of the build alternatives.

5.3.5 Historic Resources

No properties listed in the NRHP have been identified in the area within one block of the alternatives. There are also no properties designated as landmarks by either the City of Seattle or the City of Shoreline. Other jurisdictions along the corridor do not have ordinances for historic preservation, which also establish a landmark process.

Previous studies have identified four properties in the City of Shoreline that may be eligible for listing in the NRHP, although it is likely that further study during an EIS would identify other properties:

- Red Brick Road (Ronald Road, North 173rd to 179th Streets)
- Erickson House (19502 Aurora Avenue North)
- Melby's Echo Lake Tavern (19508 Aurora Avenue North)
- Auto Camp (17203 Aurora Avenue North)

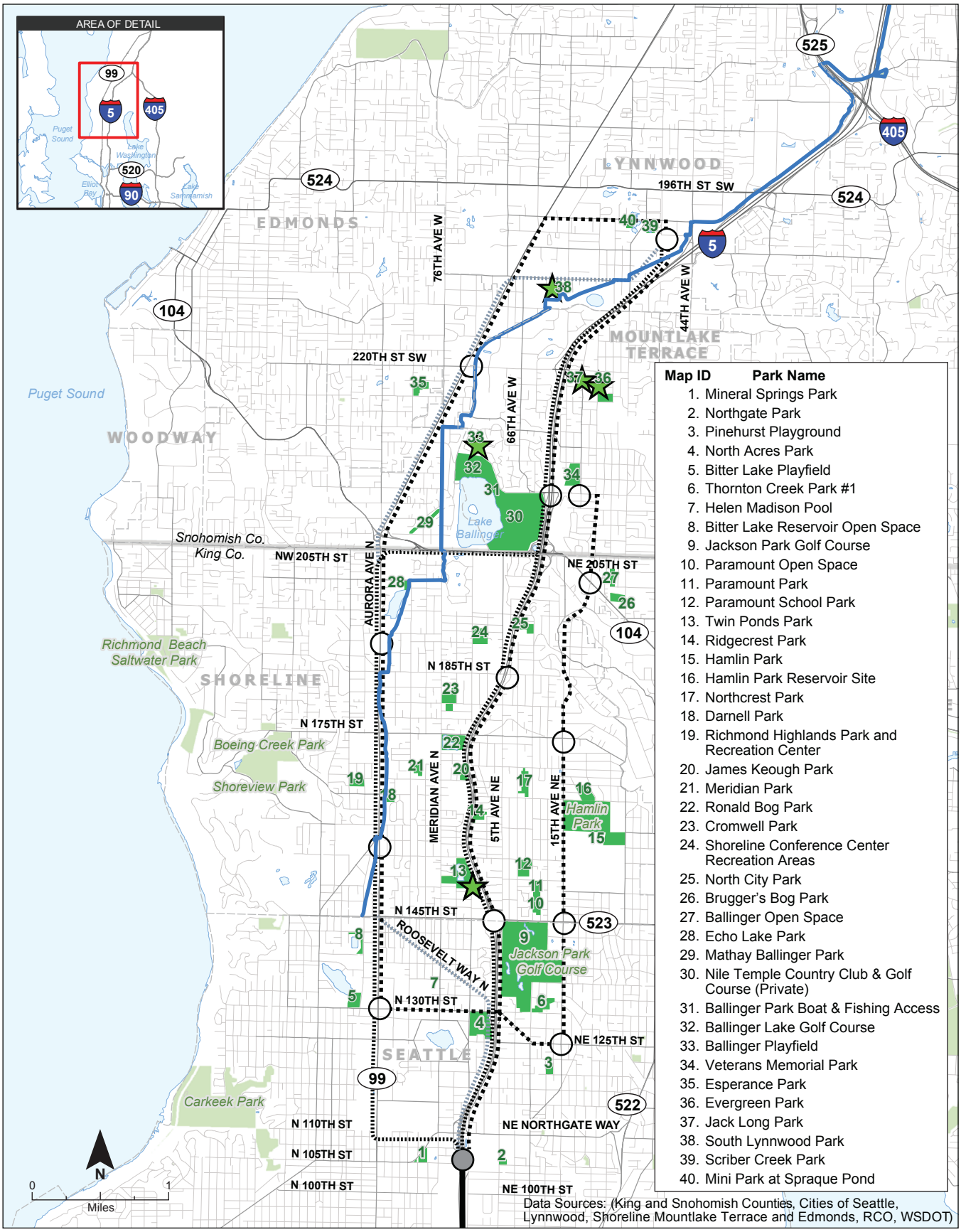


Figure 5-22. Parks and Recreation Facilities in the Project Area

A visual review of these known properties indicates these four properties are still in existence with no apparent changes to alter their potential eligibility for listing in the NRHP. Of these four properties, only the Auto Camp at 17203 Aurora Avenue North would be in a location that could be directly affected by the L2: SR 99 Mixed Profile Light Rail Alternative or the L3: SR 99 Elevated Light Rail Alternative. The other three properties would not be directly affected by any alternative. Along SR 99, a small number of pre-World War II highway buildings remain. Most have been significantly altered and some are completely unrecognizable as older structures. Closer inspection may identify additional buildings that are potentially eligible for NRHP listing.

The No Build Alternative and the TSM/Baseline Alternative would have no direct effect on historic resources.

The L1: I-5 Light Rail Alternative involves property acquisitions along the east side of the freeway and at certain interchanges. Buildings in these areas date primarily from the 1940s to the 1960s, with some more recent apartment and commercial buildings. It is unlikely that any of them are eligible for listing in the NRHP, but further research and consultation with the DAHP would be needed to confirm the status of individual properties.

The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives are likely to require full property acquisitions along their alignments. Development took place along the SR 99 corridor earlier than on the I-5 corridor, so there is a greater chance that older and more significant structures would be affected. One of the affected parcels is a property that is known to be potentially eligible for listing in the NRHP (the Auto Camp at 17203 Aurora Avenue North). The area also has several houses from the 1920s that may be intact and are potentially eligible.

The B2: Multi-Corridor BRT Alternative would have limited property acquisitions, and it does not appear that acquisitions would directly impact historic resources.

5.3.6 Archaeological Resources

A review of previously recorded archaeological sites on the DAHP online records system (WISAARD) suggests that no archaeological sites have been recorded in proximity to any of the build alternatives. However, unrecorded archaeological sites may exist throughout the project area for two reasons: 1) these areas have not been surveyed, or 2) surveys have been conducted, but did not include subsurface probing.

Using GIS, the build alternatives were overlaid on DAHP's GIS-driven archaeological probability model for the project area. This assessment helps measure how the location and amount of construction needed to build a given alternative can affect its risk for encountering archaeological resources. DAHP's model uses archaeological sensitivity factors common to most archaeological probability models (e.g., distance to water sources, landform type/slope) to predict the archaeological sensitivity of all the lands in the state for the purpose of recommending further study. Archaeological field surveys that include subsurface probing would be required to further refine DAHP's model outputs in the project area, and to provide more detailed information required for some areas, particularly high sensitivity zones.

Based on DAHP's model, all of the alternatives include low, moderate, and at least some areas of higher risk, generally in areas that have not been previously developed. DAHP "recommends" an archaeological field survey for areas identified as having a moderate risk for encountering archaeological materials, and "highly advises" that a survey be conducted for areas of high and very high risk.

The L1: I-5 Light Rail Alternative would travel through High- and Moderate-risk areas as defined in DAHP's archaeological probability model, and it has more areas that appear to have had limited development compared to the SR 99 alternatives. The northern part of the L2: SR 99 Mixed Profile Light Rail Alternative covers the same area as the L1: I-5 Light Rail Alternative; the southern part traverses moderate-risk areas to the west, and more of its immediate areas have been previously developed. Risks of encountering archaeological resources from the SR 99 variations would be similar to the L2: SR 99 Mixed Profile Light Rail Alternative. Risks for the L3: SR 99 Elevated Light Rail Alternative would be similar to the L2: SR 99 Mixed Profile Light Rail Alternative. Although the TSM/Baseline and B2: Multi-Corridor BRT Alternatives run through moderate- and high-risk areas, construction for both alternatives would be minimal, lowering their risk.

5.3.7 Air Quality and Greenhouse Gas Emissions

This measure assesses the ability to support air quality management goals and maintain conformity with the State Implementation Plan. Both air quality effects and greenhouse gas emissions were evaluated on a regional scale and include all the vehicle movements occurring in King, Pierce, Snohomish, and Kitsap counties.

This analysis identifies the potential for alternatives to improve or worsen air quality for criteria pollutants and affect the region's ability to meet or maintain air quality standards. Pollutant emission factors for vehicles in the region traveling on an arterial or highway were estimated using the latest version of the U.S. Environmental Protection Agency (EPA) emission factor algorithm (MOBILE6.2.03). Greenhouse gas emissions, discussed in terms of carbon dioxide equivalents (CO2e) were estimated using EPA's MOVES emission factor program, as is recommended by EPA. Sound Transit's Regional Forecasting Model, in conjunction with PSRC's Regional Travel Demand Model, was applied to generate 2030 forecasts for the No Build, TSM/Baseline, and each of the build alternatives (Sound Transit 2010d, 2010e). Potential change in regional vehicle miles traveled (VMT) and vehicle hours traveled (VHT) were used to estimate the criteria pollutants and greenhouse gases emitted in the region. The 2030 build alternative conditions were compared to the 2030 No Build Alternative conditions.

Most project alternatives are predicted to have positive effects on regional air quality and greenhouse gas emissions. While on a regional scale the percentage change is relatively small, the reductions would provide measurable environmental benefits. The light rail alternatives would result in decreases in both regional air pollutant emissions and greenhouse gas emissions compared to the No Build Alternative. The L1: I-5 Light Rail Alternative would reduce greenhouse gas emissions by about 235 tons daily, and the L3: SR 99 Elevated Light Rail Alternative would reduce greenhouse gases by about 223 tons daily. Similar reductions in

pollutants would also occur for these alternatives. Smaller to minimal reductions in greenhouse gas emissions would result with the L2: SR 99 Mixed Profile Light Rail Alternative and the TSM/Baseline and B2: Multi-Corridor BRT Alternatives. In all cases, the build alternatives would have lower VMT and VHT than the No Build Alternative; therefore, they are expected to have a beneficial effect on regional air quality and greenhouse gas emissions, compared to the No Build Alternative.

5.3.8 Aesthetics

The potential aesthetic effects were identified by evaluating the visibility of the proposed alternatives from nearby viewing locations, including from residential, commercial, and civic land uses. The proposed alternatives were evaluated for changes in scale and character from the existing visual context, and for the potential sensitivity of viewers to the changes in the visual character of the landscape.

Under the No Build Alternative, the project area would be expected to see incremental redevelopment of individual sites. Although these areas could change over time, in most locations the analysis assumes the future conditions would have similar visual character and scale to existing development, particularly in residential areas.

The build alternatives vary in the scale and potential character of proposed built elements. For the TSM/Baseline and B2: Multi-Corridor BRT Alternatives, changes are generally limited to station development or direct access ramps. Under the TSM/Baseline Alternative, visual effects could be associated with expanded park-and-ride facilities at NE 175th Street, where the proposed lot would be a large scale addition, and at NE 145th Street, where a relatively small existing park and ride lot would be replaced with a much larger lot, and mature conifers screening the site would be removed.

For the TSM/Baseline and B2: Multi-Corridor BRT Alternatives, the proposed park and-ride structure at the Shoreline Park-and-Ride adjacent to SR 99 would be larger than the nearby commercial development existing on the highway.

The L1: I-5 Light Rail Alternative generally follows the east edge of the I-5 right-of-way up to Mountlake Terrace. In these areas, the light rail alignment would generally replace mature landscape and would result in transportation infrastructure closer to existing homes. This could reduce visual quality for residences along the route.

In most locations along the alignment, adjacent homes are single story, and do not have direct views of vehicles on I-5. Where the light rail structures or train cars are visible, it represents a qualitative change in the type of view from the home. Elevated segments tend to be the most visible. Where the facility can be developed below the top of the current freeway depression, the current noise walls would often serve to block the views from adjacent homes and the visual effects would typically be limited to removal of existing vegetation and visible power lines.

Several stations proposed for the I-5 Light Rail Alternative would also be adjacent to residential development. The station that has a higher potential for visual effects is the NE 145th Street Station, where the platforms and associated infrastructure are elevated above the roadway, and the proposed parking facility would be visible from surrounding single family residences. Multi-story park-and-ride structures near residential properties also could occur at NE 185th Street in Shoreline.

The L1: I-5 Light Rail Alternative could result in changes in the character of the visual environment for the residents nearest to I-5; they would experience the effects frequently and over a long period. In some cases, the limited right-of-way may not allow reestablishment of a vegetative buffer, reducing opportunities for mitigation through replanting or screening.

The L2: SR 99 Mixed Profile Light Rail or L3: SR 99 Elevated Light Rail Alternatives would be largely or fully elevated along SR 99. They both would result in changes to the visual character of the urban fabric in the corridor, with at-grade sections of the L2: SR 99 Mixed Profile Light Rail Alternative resulting in less visual impact than elevated sections of either SR 99 light rail alignment. There are two cemetery properties where there could be greater sensitivity to visual effects of the facilities. Other changes (indirect) are likely to be from redevelopment along the corridor to infill the property where existing structures would be removed to accommodate light rail. For the east-west transitions between I-5 and SR 99, the elevated structure would be near some residences and would change the visual character of these areas.

The Roosevelt Way Variation for the L2: SR 99 Mixed Profile Light Rail Alternative would be out of scale and character with the neighborhood setting, with a high potential for visual quality effects.

Effects along the SR 99 portion of the SR 99 North Variation would be similar to the primary L2: SR 99 Mixed Profile Light Rail Alternative. A light rail facility along 208th Street SW would be a major change of scale and character from the existing conditions.

5.3.9 Noise

Potential noise effects were identified based on the general location of noise-sensitive land uses relative to the alternative alignments and modal elements. The project used FTA and the FHWA guidance for analyzing categories of noise-sensitive land uses. The most sensitive category is for land uses where quiet is essential to their intended purpose such as amphitheaters and historic landmarks. Noise at residences, hospitals, hotels, and other buildings where people sleep are in the second sensitive category. The third general category of noise-sensitive land uses includes schools, libraries, churches, cemeteries, and recreational facilities. Multiple units in buildings such as hotels, motels, and apartments are considered individually.

Noise-sensitive land uses located along the North Corridor include residences, schools, recreation areas, hotels, churches, libraries, cemetery lands, and medical facilities.

The project examined the noise-sensitive land uses within 100 feet of the alternatives to help measure the potential for noise effects to occur. Noise-sensitive sites at greater distances from

project alignments were also considered, because some locations could have noise effects at a greater distance due to topography, alternative design, existing noise conditions, and the operation of the alternatives.

The project then provided a qualitative assessment of potential noise effects to help compare how each alternative could change the existing noise environment. The assessment also considered existing noise mitigation in place along I-5, as well as potential property acquisitions along all alternatives.

Under the No Build Alternative, the project area would experience development patterns similar to those seen currently, which would likely result in minor changes to the existing noise environment.

Potential noise effects anticipated under the TSM/Baseline Alternative would be the lowest of all build alternatives due to the limited construction area and facility improvements. Noise effects may occur near the expanded park-and-ride facilities at NE 175th Street and NE 145th Street.

A large number of noise-sensitive land uses are located along the L1: I-5 Light Rail Alternative. This alignment runs alongside I-5 where nearby noise-sensitive sites (residences, parks, and churches) currently experience high traffic noise levels from vehicles traveling on I-5. Noise barriers are located intermittently along this alignment to partially shield highway noise and could serve to shield future at-grade light rail noise if relocated. The elevated sections of the L1: I-5 Light Rail Alternative could require additional mitigation measures to prevent noise effects from occurring at close proximity to the alignment and further from the alignment. Areas with the highest potential to experience noise effects are single-family residences located east of I-5 from NE 116th Street to NE 130th Street and from NE 148th Street to 232 Street SW.

The L2: SR 99 Mixed Profile Light Rail Alternative is also located near a large number of noise sensitive land uses. As with the I-5 alternative, noise-sensitive sites along the northern portion of the alignment are primarily single-family residences with limited multi-use apartments and hotels. The southern portion of the L2: SR 99 Mixed Profile Light Rail Alternative is located near more commercial areas, but it also has single-family residences and hotels, motels, and apartment buildings with a higher concentration of noise-sensitive living units. Residential areas located along North 110th Street and along NE 205th Street, where the alignment shifts to and from I-5, have the highest potential to experience noise effects from the L2: SR 99 Mixed Profile Light Rail Alternative. Apartments, hotels, and motels located along SR 99 also have the potential to experience noise effects from the L2: SR 99 Mixed Profile Light Rail Alternative with areas located nearest the elevated light-rail alignment having a higher potential for noise effects and changes to the existing noise environment. Noise mitigation along SR 99 would be more difficult than along I-5 due to the high frequency of existing driveways and cross-streets located along SR 99.

The L2: SR 99 Mixed Profile Light Rail Alternative Roosevelt Way Variation is located near a large number of single-family residences located both east and west of Roosevelt Way North from NE

130th Street to North 145th Street. Residents living along Roosevelt Way North would likely experience noise effects due to a high potential for changes to the existing noise environment. Noise mitigation along the Roosevelt Way Variation would be restricted to noise barriers located along the elevated guideway, which increases the scale of the guideway. Otherwise, noise insulation for home interiors would be needed. Noise walls would be less effective due to the high frequency of existing driveways and cross-streets located along Roosevelt Way North.

The SR 99 North Variation of the L2: SR 99 Mixed Profile Light Rail Alternative is located near a large number of apartment buildings, hotels and motels, and areas of single-family residences located east and west of SR 99 from NW 205th Street to 208th Street SW. This alignment follows 208th Street SW and runs near a large number of single-family and multi-family residential units. Noise-sensitive sites located along SR 99 and 208th Street SW would likely experience noise effects. A potential for changes in the existing noise environment is likely along the entire SR 99 North Variation, with a higher likelihood at residences located along 208th Street SW because this area does not currently experience high traffic noise levels. Noise mitigation along the SR 99 North Variation could include noise barriers located along the elevated guideway, but mitigating impacts to at-grade sections could potentially require residential sound insulation. Noise walls along the roadway would be less effective because of the high frequency of existing driveways and cross-streets located along SR 99 and 208th Street SW.

Anticipated noise effects and changes to the existing noise environment from the L3: SR 99 Elevated Light Rail Alternative would be similar to those detailed for L2: SR 99 Mixed Profile Light Rail Alternative, with noise from the elevated light-rail trains extending farther east and west of SR 99 from approximately North 120th Street to North 143rd Street, and approximately North 155th Street to North 173rd Street. If mitigation is needed, the most likely noise mitigation along SR 99 would likely be noise barriers located along the elevated guideway.

The B2: Multi-Corridor BRT Alternative is near a large number of noise-sensitive sites, but it involves less change to existing features or facilities than the light rail alternatives. This alignment primarily follows existing I-5, SR 99, and 15th Avenue NE corridors where nearby noise-sensitive sites currently experience high traffic noise levels and frequent bus operations. Noise barriers are located along several areas of the I-5 alignment that partially shield highway noise and would serve to shield future noise from BRT operations. While noise effects could still occur with the B2: Multi-Corridor BRT Alternative, this alternative would likely result in the second-lowest noise effects and would result in limited changes to the existing noise environment along much of the alignment. The area currently experiences high traffic noise levels from vehicles traveling on I-5, SR 99, and 15th Avenue NE. If mitigation is required for the B2: Multi-Corridor BRT Alternative, there would be the option to place or improve noise barriers along the I-5 corridor. However, mitigation along the SR 99 and 15th Avenue NE corridors would be more difficult due to high frequencies of side-streets and driveways along these routes.

Noise effects from construction of the project would also be a factor for all alternatives. Noise generated by heavy equipment would be as close as 50 feet from existing structures along several of the alignments. In a number of areas along all the light rail alternatives, many of the

adjacent structures are residential, which would be sensitive to noise from construction. The light rail alternatives would generate more construction noise than the TSM/Baseline and B2: Multi-Use Corridor BRT Alternatives because construction under the non-light rail alternatives would not occur along the entire length of the corridor.

5.3.10 Property Acquisitions and Displacements

Implementing transit improvements in the corridor will require acquisition of property for right-of-way, including alignments, stations, and other facilities. This would result in displacing and relocating some of the existing uses. This section summarizes estimates of the amount of right-of-way that would be needed outside of existing transportation rights of way, the effects here are based on the current conceptual designs. There are two types of property acquisitions:

- A partial acquisition would acquire part of a parcel but would not necessarily dislocate the existing use.
- A full acquisition would acquire the full parcel and displace the current use.

Table 5-24 summarizes the potential number of affected properties and the acreage of right-of-way needed for each alternative, and also discusses the types of land use potentially affected. Other effects associated with right of way are discussed in Section 5.2, Land Use and Economic Development Potential and Section 5.4, Community Equity.

The project corridor is a highly developed urban area with a high number of business/commercial and residential properties. With the exception of the No Build Alternative, each of the other alternatives would need new right-of-way, which would affect properties owned by others.

The alternative with the lowest right-of-way needs would be the TSM/Baseline Alternative, which would have very limited impacts. Under the TSM/Baseline Alternative, station improvements at Northgate, 175th Street/Meridian Avenue, and 175th Street/15th Avenue NE may require some minor property acquisitions and easement rights. Design details of these improvements have not been determined, but it is assumed that improvements would range from minor parking area acquisitions to approximately 4 to 5 acres of new right-of-way. Up to five properties could have potential full or partial acquisition impacts.

The L1: I-5 Light Rail Alternative would require 21 to 22 acres for new right-of-way. While details on the specific properties potentially affected would require a higher level of design, 140 to 170 properties could be affected by full or partial acquisitions, and more of the affected properties would be residences.

The L2: SR 99 Mixed Profile Light Rail Alternative and its two route variations would require the most right-of-way with the highest potential for acquisitions and displacements. The primary L2: SR 99 Mixed Profile Light Rail Alternative would require approximately 43 to 44 acres. Although details on the specific properties potentially affected would require a higher level of design, 320 to 370 properties could be affected by full or partial acquisitions. Most of these likely affected properties are businesses along the SR 99 corridor and involve larger parcels than the affected properties along the I-5 light rail alignment.

Table 5-24. Summary of Right-of-Way Needs and Affected Property Types

Alternative	Percent Commercial/ Industrial	Percent Public/ Institutional	Percent Residential Single Family	Percent Residential Multi-Family	Percent Parking/ Vacant	Total Property Acquisitions*	Total Percent Partial Acquisitions	Total Percent Full Acquisitions	Total Affected Acres
TSM/Baseline	25%	25%	0%	25%	25%	0-5	100%	0%	4-5
L1: I-5 Light Rail	10-15%	5%	60-65%	5-10%	10%	140-170	45-50%	45-50%	21-22
L2: SR 99 Mixed Profile Light Rail	80%	0-5%	5%	5%	5-10%	320-370	70-75%	25-30%	43-44
L2: with SR 99 North Variation	70%	0-5%	10%	5%	5-10%	420-440	70-75%	25-30%	70-71
L2: with SR 99 Roosevelt Way Variation	60%	0-5%	20-25%	5%	5-10%	240-270	60-65%	35-40%	39-40
L3: SR 99 Elevated Light Rail	80%	0-5%	5-10%	5%	5-10%	200-230	65-70%	30-35%	39-40
B2: Multi-Corridor BRT	25%	0%	30%	15%	30%	20-30	55-60%	40-45%	7-8

*These numbers represent a range of properties that could be affected by full or partial acquisitions. Details on the specific properties potentially affected would require a higher level of design.

For the Roosevelt Way Variation, the total acreage would be reduced by about 3 acres because the route would be shorter. This would also reduce the total number of affected properties to about 240 to 270 parcels if it were used for the L2: SR 99 Mixed Profile Alternative. While this option would avoid some impacts to commercial properties, it would increase the number of residential properties affected, with potentially 30 to 60 more residential properties being affected along Roosevelt Way.

The SR 99 North Variation would increase the total acreage for new right-of-way by about 25 acres, including commercial properties along SR 99, but also including some residential uses. Up to 100 more properties could be affected, compared to the primary alignment following I-5 from the Mountlake Terrace Station and to the north.

The L3: SR 99 Elevated Light Rail Alternative would require about 39 to 40 acres of right of way and its smaller footprint along SR 99 avoids some of the effects of the L2: SR99 Mixed Profile Alternative. About 200 to 230 properties could have potential full or partial acquisition impacts.

The B2: Multi-Corridor BRT Alternative would require approximately 7 to 8 acres, including areas for expanded transit centers and park-and-rides. Between 20 and 30 properties could be affected by full or partial acquisitions.

5.3.11 Transportation

The transportation system was evaluated for each alternative based on general purpose traffic operations, transit operations, pedestrian and bicycle travel, safety, and travel during construction.

GENERAL PURPOSE TRAFFIC OPERATIONS

Effects on general purpose traffic operations for each alternative were assessed based on changes in 2030 traffic volumes and operations of the freeway and arterials. General purpose traffic operations were evaluated along each alternative alignment, including consideration of the modifications required to achieve acceptable LOS operation, as well as assessments of effects on local traffic circulation and property access. The following measures were used to assess each alternative's effects on general purpose traffic operations:

- **I-5 Operation:** Effects on I-5 freeway traffic operation were measured through consideration of changes in volume-to-capacity (v/c) ratios at freeway screenlines, changes in operation in the HOV lanes, and changes in operation at interchange ramps and ramp areas.
- **Arterial Operation:** Effects on arterial traffic operation were measured based on intersection LOS along the alternative routes, intersection LOS near park and-ride lots and transit stations, effects along arterial BAT lanes, and the level of modification to maintain arterial operation. Changes in signal phasing and timing, turn lane storage, intersection volumes, and transit priority treatments are expected to influence intersection operation.
- **Local Traffic Circulation and Property Access:** The effects of the alternatives on local circulation and property access were measured by the amount of change in access that would be required with the alternative, including control of side-street and driveway access along at-grade light rail alignments.

A summary of the anticipated effects on general purpose traffic operations with each alternative is presented in Table 5-25.

Freeway and arterial traffic operations were evaluated for the Level 2 Alternatives by comparing v/c ratios at screenlines. An east-west screenline just south of the King Snohomish County line captures the I-5 mainline, I-5 HOV lanes, SR 99, and key north south arterials between 20th Avenue NW in Shoreline and Brier Road in Lake Forest Park. V/c ratios at this screenline, presented in Figure 5-23, indicate that all of the build alternatives would reduce traffic volume along key arterial and highway corridors compared to No Build conditions. However, the reduction in v/c ratios is not enough to provide a measurable improvement in peak-period traffic operations for most alternatives and should only be used as a general indicator of each alternative's potential to induce a shift in travel mode. Other operational factors, such as proposed changes in HOV lane operation, and changes in operation at interchange ramps and ramp areas also affect freeway operations for each alternative.

Table 5-25. Level 2 Evaluation Results—General Purpose Traffic Operations

Alternative	I-5 Operations	Arterial Operations	Local Circulation and Property Access
TSM/Baseline	Little or no effect on I-5 traffic. Higher volumes of buses in HOV lane.	Higher bus volumes on arterials with more transit signal priority could result in additional delay for general purpose traffic. Potential local effects related to increased traffic at Lynnwood and Shoreline Park-and-Ride lots.	No change.
L1: I-5 Light Rail	Little or no effect on I-5 traffic, with a possible slight decrease in v/c and slight improvement in freeway operation. Slight improvement in HOV lane operation with reduced number of buses in HOV lane.	Potential local effects related to increased traffic at transit stations and park-and-ride lots.	No change.
L2: SR 99 Mixed Profile Light Rail*	No change in I-5 traffic or operation.	All existing signals to remain. Light rail in the median requires widening at signals to replace left-turn lane. Widening for left-turn lane requires reconstruction of SR 99. Dual left-turn lanes needed at North 125th, North 130th, North 145th, and North 160th Streets to maintain LOS. The resulting wider intersections lengthen pedestrian crossing distances, increase crossing time, and increase delay for side-street traffic. Potential local effects related to increased traffic at Lynnwood and Shoreline Park-and-Ride lots.	Light rail in the median limits access and circulation, whether at-grade or elevated. Light rail in the median limits access at minor streets and driveways to right in/right out only. No left-turn lane possible at North 112th Street (cemetery entrance) or North 117th Street (Home Depot entrance).
L3: SR 99 Elevated Light Rail	Little or no effect on I-5 traffic, with a possible slight decrease in v/c and minimal improvement in freeway operation. Slight improvement in HOV lane operation with reduced number of buses in HOV lane.	All existing signals to remain. No change in arterial operation north of North 130th Station. Side-running elevated alignment would have little impact on traffic signals at and north of North 125th Street. Potential local effects related to increased traffic at Lynnwood and Shoreline Park-and-Ride lots.	No change in local street operation or circulation north of North 130th Station. Light rail columns in the median south of North 125th Street would limit access and circulation, further limiting access at minor streets and driveways to right in/right out only. No left-turn lane possible at North 112th Street (cemetery entrance) or North 117th Street (Home Depot entrance). Column location may constrain driveway operations and may require driveway consolidation with possible signal control at SR 99 for driveway access.
B2: Multi-Corridor BRT	Additional buses in HOV lanes. Direct access transit ramps eliminate the weave between the HOV lane to the ramp terminals, benefiting buses and general purpose traffic operations.	Additional buses in SR 99 BAT lane may affect right-turning traffic. Potential local effects related to increased traffic at Lynnwood and Shoreline Park-and-Ride lots. Higher bus volumes on arterials with more transit signal priority could result in additional delay for general purpose traffic.	Increased bus volumes in the SR 99 BAT lanes may affect driveway access/egress.

* The SR 99 North Variation and Roosevelt Way Variation would result in similar effects on freeway operations. The effect of light rail design and operations along at-grade and elevated segments of the SR 99 alignment would be greater with the SR 99 North Variation and less with the Roosevelt Way Variation, based on the length of the alignment running at-grade in the SR 99 median.

With all alternatives, localized increases in traffic would be generated by park-and-ride facilities and transit stations. At nearby intersections, traffic volumes would likely increase and congestion worsen during peak periods, with the magnitude of change depending on the proximity to the park-and-ride, the lot size, and the volume of traffic already traveling through the intersection. Figure 5-24 shows the study intersections where traffic congestion is anticipated to degrade with the Level 2 Alternatives compared to the No Build Alternative.

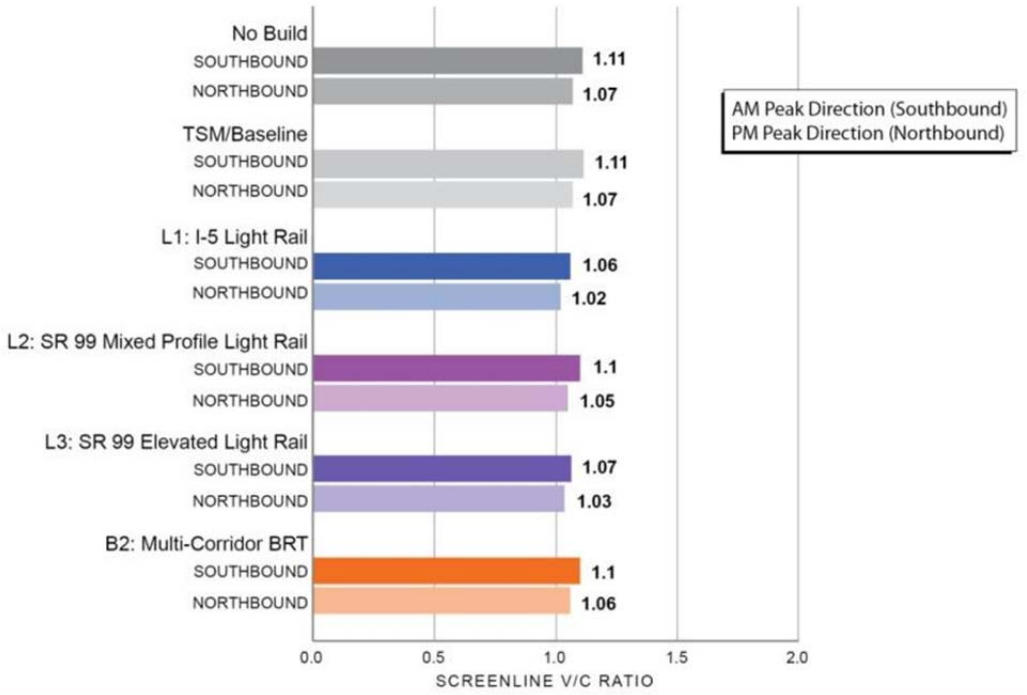
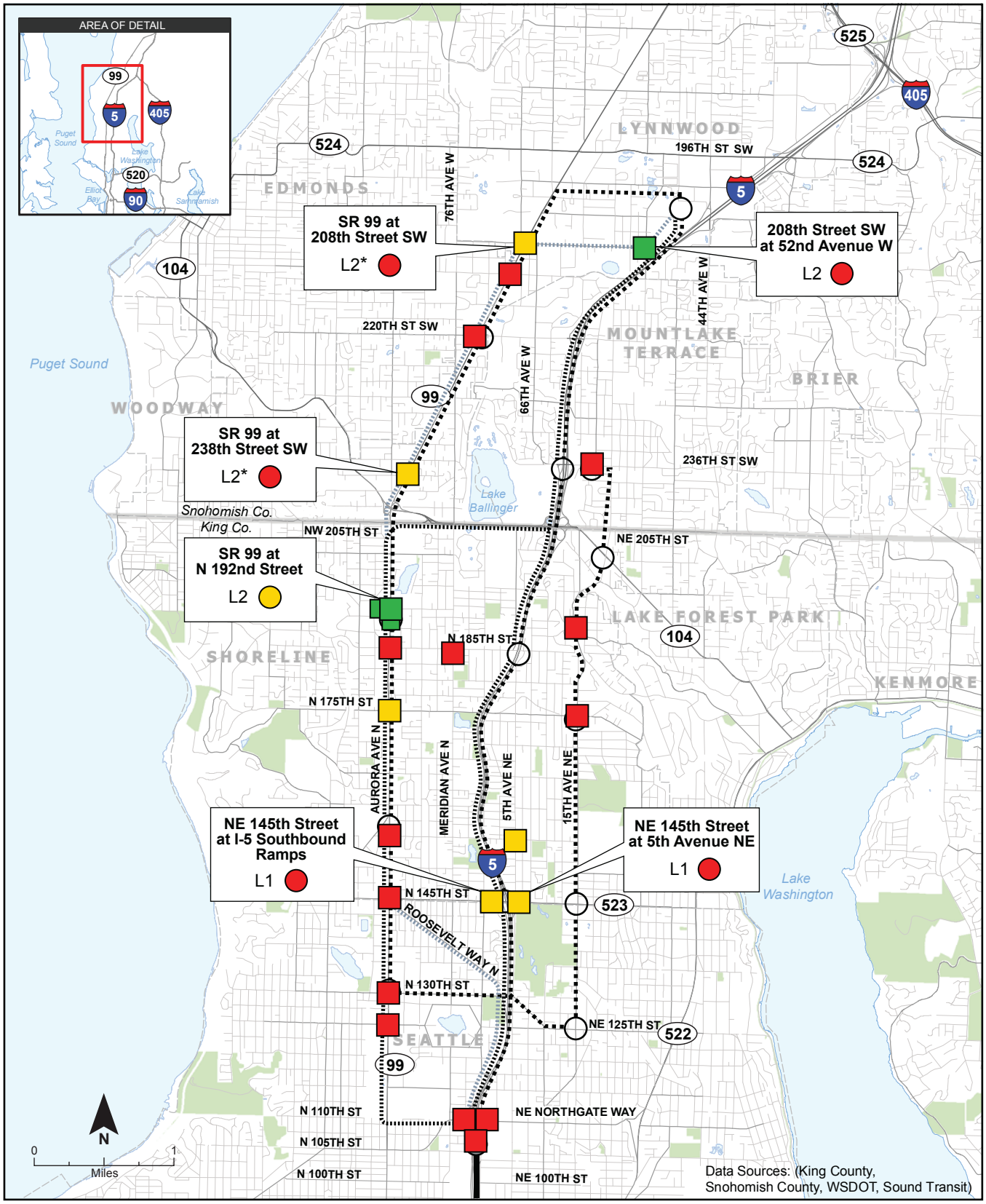


Figure 5-23. Screenline V/C Ratios at King/Snohomish County Line

As indicated in Figure 5-24, the most notable changes in congestion are likely to occur near new or expanded park-and-ride lots, and along arterial corridors with at-grade or median elevated light rail.

The TSM/Baseline and B2: Multi-Corridor BRT Alternatives could have minor effects on general purpose traffic operations near expanded park-and-ride facilities and with additional implementation of transit signal priority treatments along key transit arterial corridors.

The L1: I-5 Light Rail Alternative could also have minor effects on general purpose traffic operations in the vicinity of the stations with expanded park-and-ride facilities. This alternative could also result in a small decrease in freeway and arterial traffic volume, because some general-purpose trips would shift to transit, particularly along the I-5 corridor.



Notes: Levels of delay with alternatives are only shown for locations where delay would worsen by one or more levels.
*The results reported for the L2: SR 99 Mixed Profile Light Rail Alternative at these locations are for the SR 99 North Variation only.

Figure 5-24. Intersections Worsened by Level 2 Alternatives - PM Peak Hour

The L2: SR 99 Mixed Profile Light Rail Alternative would have the greatest effect on general purpose traffic operations, with the mix of elevated and at-grade median alignment through the SR 99 corridor. As shown in Figure 5-24, this alternative would result in the highest number of intersections with degraded operations, mostly due to median rail operations along SR 99. Effects on intersection operations could be mitigated with widening at intersections to provide replacement left-turn lanes and left-turn storage to manage traffic. In addition, where light rail is in the median (at-grade or elevated), access at driveways and stop controlled side streets would be converted to right in/right out only. Left-turn movements would be accommodated by U-turns at signals and these movements would experience a noticeable increase in delay. A left-turn lane used for U-turns requires a wide right lane to complete the U-turn. The analysis results shown in Figure 5-24 assume that a number of these measures would be included as part of the L2: SR 99 Mixed Profile Light Rail Alternative to maintain overall intersection operations similar to the No Build Alternative; however, even with these improvements left-turn movements and cross-street movements (for both vehicles and pedestrians), would be severely affected.

The effect of light rail design and operations along at-grade and elevated segments of the SR 99 alignment would be greater with the SR 99 North Variation and less with the Roosevelt Way Variation, based on the length of the alignment running at-grade in the SR 99 median. The SR 99 North Variation would degrade operations at an additional two intersections along SR 99 north of the King County/Snohomish County line compared to the primary alignment, and the Roosevelt Way Variation would not affect any intersections on SR 99 south of North 145th Street.

The L3: Elevated Light Rail Alternative would have minor effects on general purpose traffic in the vicinity of the median alignment along SR 99 where column placement would impact left turn operations. This could impact two to three signalized intersections south of the North 130th Street station. This alternative could also result in a small decrease in freeway and arterial traffic volume because some general-purpose trips would likely shift to transit.

TRANSIT OPERATIONS

Measures relating to transit operations include benefits and effects associated with each alternative or the conditions in which they operate. Depending on the alternative, transit benefits would include service operating in exclusive rights-of-way, direct access ramps connecting HOV lanes to transit centers, and transit signal priority treatments. Potential benefits and effects include reduced transit travel time, improved transit service reliability, changes in transit operations, potential delay, and route structure changes to local bus routes. The effects on transit operations include the truncating of routes to serve light rail alternatives and then an increase in ridership as bus routes serve new light rail stations. Some form of bus service modifications would occur with all alternatives.

The effects and benefits expected for transit operations are summarized in Table 5-26 by alternative.

Table 5-26. Level 2 Evaluation Results—Transit Operations

Alternative	Transit Effects/Conditions	Transit Benefits
TSM/Baseline	Increasing congestion over time in HOV lanes would degrade the travel time and reliability of transit on the I-5 and SR 99 express bus routes.	Additional express bus routes would connect to Northgate Station. Provision of separate transit lane and left-turn lane for buses in Northgate interchange area would improve transit speed and reliability. Bus operations at Aurora Village Transit Center would be relocated to the Shoreline light rail station. BRT and local feeder service would be provided at a single location.
L1: I-5 Light Rail	Commuter bus operations on I-5 would be truncated at Lynnwood Transit Center Station, Mountlake Terrace Station, and 185th Street Station to feed light rail stations. Local bus service would be adjusted to complement light rail. Ridership on existing Community Transit *Swift* and King County Metro RapidRide BRT services would potentially decrease as a result of competing light rail service in the corridor.	Light rail operating in exclusive right-of-way would provide a high level of speed and reliability for transit. Light rail would replace some buses in I-5 corridor, freeing up service hours for other local service.
L2: SR 99 Mixed Profile Light Rail*	Community Transit I-5 commuter routes connecting south Snohomish County to downtown Seattle and to the University of Washington would continue to operate as they do today, with the exception of routes that currently originate in Edmonds and provide service to downtown Seattle and the University District, which would terminate at the Mountlake Terrace Freeway Station and Shoreline Transit Center Station where passengers would transfer to light rail. Commuter bus operations from north Snohomish County would not be affected. Sound Transit bus operations in south Snohomish County on I-5 would be truncated at Lynnwood Transit Center Station to serve light rail stations. Local bus service would be adjusted to complement light rail. Ridership on existing King County Metro RapidRide BRT service would potentially decrease as a result of competing light rail service in the corridor.	Light rail would provide a high level of speed and reliability for transit, although the SR 99 alignment is slower than on I-5, and may be slower than express bus service between selected trip pairs. Light rail may replace some buses in I-5 corridor, which could shift service hours to local service. Existing Community Transit *Swift* BRT service would provide feeder service to light rail, potentially increasing ridership on the BRT service. Bus operations at Aurora Village Transit Center would be relocated to the Shoreline light rail station. Rail, BRT, and local feeder service would be provided at a single location.
L3: SR 99 Elevated Light Rail	Commuter bus operations on I-5 would be truncated at Lynnwood, Mountlake Terrace, and Shoreline transit centers to feed light rail stations. Local bus service would be adjusted to complement light rail. Ridership on existing King County Metro RapidRide BRT service would potentially decrease as a result of competing light rail service in the corridor.	Light rail operating in exclusive right-of-way would provide a high level of speed and reliability for transit. Light rail would replace some buses in I-5 corridor, freeing up service hours for other local service. Existing Community Transit *Swift* BRT service would provide feeder service to light rail, potentially increasing ridership on the BRT service. Bus operations at Aurora Village Transit Center would be relocated to the Shoreline light rail station. Rail, BRT, and local feeder service would be provided at a single location.
B2: Multi-Corridor BRT	Increasing congestion over time in HOV lanes would degrade transit travel time and reliability on the I-5 and SR 99 routes. BRT routes would terminate at Northgate Link Station; transit riders destined to Seattle would transfer to light rail. Lynnwood and Mountlake Terrace express routes would be replaced by BRT. Ridership on existing Community Transit *Swift* and King County Metro RapidRide BRT services may slightly decrease as a result of competing BRT service in the corridor.	Transit direct access ramps would provide operation improvements between I-5 HOV lanes and the Northgate Station as well as North 130th Street. Transit travel time between Lynnwood and Northgate would improve over the TSM/Baseline Alternative. Stop consolidation on SR 99 and 15th Avenue NE would improve transit travel time. Bus operations at Aurora Village Transit Center would be relocated to the Shoreline light rail station. BRT and local feeder service would be provided at a single location.

* The SR 99 North Variation and Roosevelt Way Variation would result in similar effects on transit operations. With the SR 99 North Variation, some Community Transit I-5 commuter routes connecting south Snohomish County to downtown Seattle and to the University of Washington may terminate at the 220th Street Station where passengers would transfer to light rail. With the Roosevelt Way Variation, local King County Metro bus routes in north King County would not be able to interface with rail service at the 130th Street Station, and would need to use the Northgate and/or 160th Street stations to access light rail.

The TSM/Baseline Alternative is not expected to noticeably affect the current and proposed SR 99 BRT routes (Community Transit *Swift* service and Metro RapidRide E Line), while those services may slightly decrease with the B2: Multi-Corridor BRT Alternative.

Community Transit *Swift* and King County Metro RapidRide BRT ridership is projected to decrease under the L1: I-5 Light Rail Alternative due to the competing light rail service in the corridor.

Community Transit *Swift* BRT ridership on SR 99 is projected to increase under the L2: SR 99 Mixed Profile Light Rail Alternative as riders use it to connect with light rail at the Shoreline Park-and-Ride Station, while ridership on King County Metro RapidRide BRT service is projected to decrease. At-grade light rail in the L2: SR 99 Mixed Profile Light Rail Alternative would increase general purpose traffic delay, which would also cause delay to bus operations in the corridor on SR 99 and cross streets. These effects would be greater with the SR 99 North Variation and slightly less with the Roosevelt Way Variation, based on the length of the alignment running at-grade in the SR 99 median.

Similar to the L2: SR 99 Mixed Profile Light Rail Alternative, with the L3: SR 99 Elevated Light Rail Alternative, Community Transit *Swift* BRT ridership is projected to increase as riders could connect to rail at the Shoreline Park-and-Ride Station, while ridership on King County Metro RapidRide BRT service is projected to decrease.

Future managed lanes on I-5 could increase peak-period running speeds for buses as compared to the current HOV lane operation; however, based on sensitivity tests, it is expected that nearly all the benefits of this increased speed would be experienced by Community Transit's express routes serving downtown Seattle and the University District rather than the new North Corridor bus routes added under either the TSM/Baseline Alternative or the B2: Multi-Corridor BRT Alternative.

PEDESTRIAN AND BICYCLE TRAVEL

At this level of alternative development and analysis, the primary consideration for pedestrian and bicycle effects is the degree to which an alternative, when combined with other public improvements and private development, might alter the larger environment surrounding stations and along the alignment. Once the alternatives are developed further and more is known about station locations and configurations, a more detailed and localized analysis can be completed.

The TSM/Baseline Alternative would have little or no effects on pedestrian and bicycle travel. The modest bus stop and transit center improvements would provide some limited but very localized enhancements.

The L1: I-5 Light Rail Alternative would have effects on pedestrian and bicycle travel primarily around the station areas. The alignment itself, located within or along I-5, is not likely to result in other investments that might alter the pedestrian and bicycle environment along the

freeway. The four new stations, however, each have a varying degree of potential to become part of a larger transformation of the areas around them that could result in major improvements for pedestrian and bicycle travel.

The L2: SR 99 Mixed Profile Light Rail Alternative has the greatest potential to result in enhancements to the pedestrian and bicycle environment both in the areas around stations and along the guideway alignment. Unlike the I-5 alignment, SR 99 is a multi purpose arterial with some level of existing pedestrian and bicycle activity. In addition, the Interurban Trail, a regional bicycle and pedestrian facility, parallels a portion of the alignment. Given the level of existing pedestrian and bicycle activity and investment, and given that SR 99 would need to be reconstructed from approximately North 120th Street to North 175th Street, the L2: SR 99 Mixed Profile Light Rail Alternative, when combined with other private developments and public investments, could result in major enhancements to pedestrian and bicycle travel along SR 99.

The L3: SR 99 Elevated Light Rail Alternative would result in enhancements at the station areas. However, in contrast to L2: SR 99 Mixed Profile Light Rail Alternative, major portions of SR 99 would not have to be reconstructed under this alternative. Nonetheless, when station improvements are combined with other private developments and public investments, they could still result in major enhancements to pedestrian and bicycle travel along SR 99.

The B2: Multi-Corridor Alternative would have effects similar to the TSM/Baseline Alternative, although bus stop/station and transit center improvements would be more substantial than for the latter.

TRANSPORTATION SAFETY

The primary considerations for effects on transportation safety are potential changes in conflicts for pedestrians, bicycles, and vehicles (general purpose and transit) along the alignment, crossing the alignment, and accessing the associated facilities, such as the light rail stations, BRT stations, and park-and-ride facilities. Where the alternative is routed through highly congested intersections, the potential for conflicts would increase. Where an alternative is grade separated and or removes transit from mixed traffic operations conflicts would decrease. Table 5-27 summarizes evaluation results related to transportation safety for each of the alternatives in comparison to existing, or No Build, conditions.

For the TSM/Baseline Alternative, the potential for conflicts is expected to remain comparable to the No Build condition or very slightly increased. This alternative would increase bus volumes in mixed traffic but also include improvements that would reduce conflicts at key I-5 access locations.

All light rail alternatives would operate on exclusive guideways and would result in rail transit operations with little to no conflicts with existing traffic. The L1: I-5 Light Rail and the L3: SR 99 Elevated Alternatives, which are both fully grade separated, would result in no rail transit conflicts with other traffic.

Table 5-27. Level 2 Evaluation Results—Safety

Alternative	Vehicles	Pedestrians	Bicycles
TSM/Baseline	Little or no change. Transit operates through nine highly congested intersections.	No change	No change
L1: I-5 Light Rail	Eliminates all vehicle conflicts with regional transit services. Slight improvement in safety with reduced v/c ratios at screenlines. Reduced potential for vehicle conflicts in HOV lanes with decrease in bus volume.	No change	No change
L2: SR 99 Mixed Profile Light Rail*	Potential to increase vehicle conflicts with regional transit services where rail passes through at-grade crossings. Nature and type of vehicle accidents would change. Median alignment would also result in access control and reduced vehicle conflicts at driveways and local street intersections. Alignment passes through a number of highly congested intersections, depending on variation.	Consolidated pedestrian crossings at signal controlled locations along SR 99 should improve safety. However, longer pedestrian crossings could increase potential for pedestrian/vehicle conflicts. Access control along SR 99 could also increase jay-walking, due to long spacing between signal/controlled crossings.	Access control along SR 99 could reduce bicycle/vehicle conflicts and would also restrict bicycle mobility. At-grade intersections with light rail tracks may be a crossing hazard for turning bicyclists. Design would provide right-angle crossing to minimize hazard for bicyclists. Major turns in alignment are elevated (north variation).
L3: SR 99 Elevated Light Rail	Eliminates all vehicle conflicts with regional transit services. Median alignment south of North 125th Street would result in access control and reduced vehicle conflicts.	No change	In median alignment south of North 125th Street, access control along SR 99 could reduce bicycle/vehicle conflicts and could also restrict bicycle mobility.
B2: Multi-Corridor BRT	Little or no change. Transit would operate through seven highly congested intersections with an increased potential for vehicle conflicts. Improved safety for transit vehicles on I-5 with direct access ramps.	No change	No change

* The potential positive and negative safety effects of running an at-grade median alignment would be greater with the SR 99 North Variation and less with the Roosevelt Way Variation, based on the length of the alignment running at-grade in the SR 99 median.

The L2: SR 99 Mixed Profile Light Rail Alternative would have varying numbers of at-grade traffic crossings, depending on the alignment variation, where potential conflicts with roadway traffic could occur. The nature and type of accidents would change with an at-grade median alignment, when compared with the No Build condition. The median alignment would result in increased access control and thus would reduce vehicle conflicts along the arterial (SR 99) and some types of vehicle collisions may be reduced, e.g., those involving mid block left-turning vehicles.

For the L2: SR 99 Mixed Profile Light Rail Alternative, the design would include access control along SR 99, and locations for pedestrian crossing would be consolidated at controlled locations

(i.e., signals). The median alignment (with widening for left-turn storage at signals) would result in longer pedestrian crossing distance, which could increase potential for pedestrian/vehicle conflicts. This could be alleviated somewhat by providing safe refuges for pedestrians in the median. Long spacings between signals/controlled crossings could also potentially increase jay-walking.

The potential safety effects (positive and negative) of running an at-grade median alignment would be greater with the SR 99 North Variation and less with the Roosevelt Way Variation, based on the length of the alignment running at-grade in the SR 99 median.

The L3: SR 99 Elevated Light Rail Alternative would result in no conflicts between light rail trains and other traffic. The elevated median alignment, south of North 125th Street, would result in increased access control and reduced vehicle conflicts along the SR 99 arterial. In this segment, there would be consolidated pedestrian crossings (at signals), which could improve safety by facilitating crossings at controlled locations.

With the B2: Multi-Corridor BRT Alternative, the potential for conflicts is expected to remain comparable to the No Build condition or very slightly increased. This alternative would increase bus volumes in mixed traffic but also include improvements that reduce conflicts at key I-5 access locations.

CONSTRUCTION EFFECTS ON THE TRANSPORTATION SYSTEM

This section identifies potential construction-related disruptions that could affect the traveling public. Construction effects are measured by the severity and duration of construction activities as shown in Figure 5-25. Construction phasing has a direct effect on severity and duration. The light rail alternatives would be constructed by segments, starting at one end and moving to the other end. Construction phasing of previously built Link light rail was considered for application to the I-5 and SR 99 light rail alignments. This includes Link light rail through Tukwila (elevated light rail), which was constructed between 2005 and 2008; and Link light rail on Martin Luther King Jr. Way (at-grade median-running light rail), which was constructed between 2004 and 2008.

The TSM/Baseline Alternative would have limited construction disruptions on the transportation system. A modest level of disruption would occur with construction of the I-5 ramp improvements in the Northgate area. Park-and-ride lot expansion would result in either a portion of the park-and-ride lot closed for construction and/or the relocation of park-and-ride activity to another park-and-ride lot. Local traffic impacts would occur in the vicinity of park-and-ride lots and transit centers during construction.

Construction within the I-5 median for the L1: I-5 Light Rail Alternative would have a relatively long duration (4 years), but a relatively moderate effect on traffic operations. At locations where the guideway crosses I-5, construction may require some short-term lane closures (and possibly night-time full road closures) of I-5. It is anticipated that the L1: I-5 Light Rail Alternative would include one crossing of I-5.

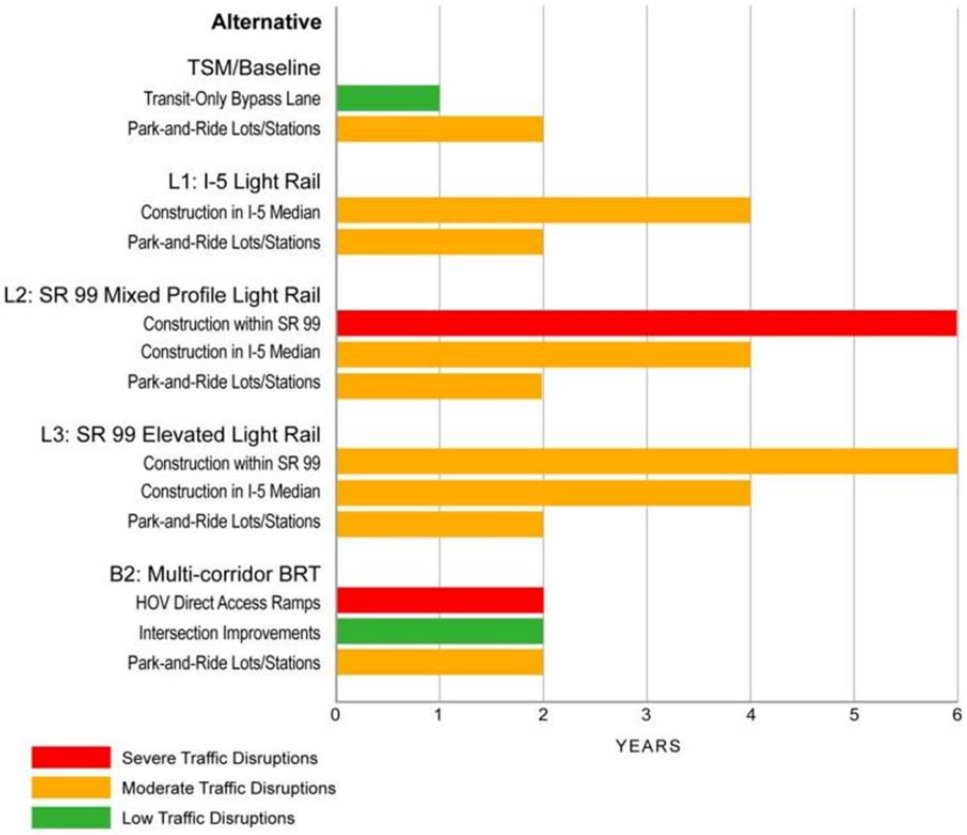


Figure 5-25. Construction Effects on Transportation System

North Corridor Transit Project | Alternatives Analysis Report

The L2: SR 99 Mixed Profile Light Rail Alternative is expected to have the highest level of traffic disruption over the longest duration (6 years) of all the alternatives. Construction along SR 99 could last approximately 6 years, with severe disruption to traffic operations. This disruption would occur in areas that have been affected by recent reconstruction projects along SR 99, and local travelers and businesses could face an additional several years of construction-related traffic disruption. The alternative would also require two to three crossings of I-5, which would likely involve periodic lane closures and temporary full closures of the freeway, and it would involve the same construction within the I-5 median as in the L1: I-5 Light Rail Alternative. The SR 99 North Variation would extend traffic construction along SR 99 farther to the north. The Roosevelt Way Variation would reduce the amount of traffic disruption on SR 99 south of North 145th Street; however, it would also create major property access and circulation problems along Roosevelt Way during construction.

The L3: SR 99 Elevated Light Rail Alternative would result in less traffic disruption to SR 99 than the L2: SR 99 Mixed Profile Light Rail Alternative because the alignment occurs primarily to one side of SR 99; however, it would be of a similar duration, and would again subject local travelers to an additional several years of construction-related traffic disruption in areas that have had major recent reconstruction. There would be more traffic disruption than for the L1: I-5 Light Rail Alternative where construction would occur primarily within existing WSDOT right-of-way (either along side or in the median of I-5) for much of the alignment. Additionally, the

estimated construction duration would be longer than with the L1: I-5 Light Rail Alternative due to the length of the L3: SR 99 Elevated Light Rail Alternative alignment. Finally, similar to the L1: I-5 Light Rail and L2: SR 99 Mixed Profile Light Rail Alternatives, the L3: SR 99 Elevated Light Rail Alternative could require some partial to full freeway closures for construction of guideway crossings over I-5. The L3: SR 99 Elevated Light Rail Alternative would include three crossings over I-5, with similar potential for traffic disruption as with the L2: SR 99 Mixed Profile Light Rail Alternative.

Construction of the I-5 HOV and/or transit direct access ramps with the B2: Multi-Corridor BRT Alternative is expected to have a high level of disruption to I-5 traffic over a 2-year duration, representing the second-greatest level of construction disruption among the alternatives.

With all alternatives, new or expanded park-and-ride lots and transit centers would result in either a portion of the park-and-ride lot closed for construction and/or the relocation of park-and-ride activity to another park-and-ride lot. Local traffic impacts would occur in the vicinity of park-and-ride lots and transit centers during construction.

5.4 COMMUNITY EQUITY

This analysis of community equity examines the potential adverse and beneficial effects on minority and low-income populations and communities, generally categorized as "environmental justice communities." Figure 5-26 illustrates the environmental justice communities in the project area based on demographic characteristics of small geographic areas defined by the U.S. Census Bureau.

Most of the analysis is based on 2000 census tract block group statistics (U.S. Census Bureau 2000) because long-range forecasts do not project demographic characteristics. Newer statistics, however, were used to assess likely changes in the study area demographics since the 2000 census. The initial alignment information for the conceptual alternatives was used to assess disruptions to communities adjacent to the alternatives. Long-range effects were examined based on minority and low-income populations residing near proposed transit stations.

All of the alternatives would traverse through or be in close proximity to minority and low-income communities. This allows the alternatives to provide transit benefits to these communities, but also increases the potential for impacts.

The study area population, comprising census block groups adjacent to the alternatives, is an estimated 31 percent minority and an estimated 9 percent low-income. Figure 5-26 shows census block groups that have minority populations above 24 percent, or low-income populations exceeding 8 percent of the total population. These thresholds for low-income and minority populations indicate higher concentrations than the average for the combined King and Snohomish County region.

Depending on the alternative, corridor minority populations range from 26 to 33 percent, which is greater than the two-county average of 24 percent. Low-income populations range between 9 and 10 percent, which is slightly greater than two-county average of 8 percent.

Based on the 2010 census, which is currently only available at the city level, the minority composition of the study area population may have increased by as much as 8 percentage points and the low income population may have increased by 2 to 3 percentage points since the 2000 census.

Potential effects on the community were considered during construction and after construction of the project alternatives. Each alternative's potential to affect environmental justice communities is influenced by its effect on community facilities, potential to displace residences and/or businesses, and potential to introduce barriers that could affect community cohesion and interaction.

5.4.1 Construction Effects

Because construction would be minimal for both the TSM/Baseline and B2: Multi Corridor BRT Alternatives, neither of these alternatives would be expected to adversely affect community cohesion. The potential acquisitions for the TSM/Baseline and B2: Multi-Corridor BRT Alternatives would be minor compared to the light rail alternatives.

In contrast, construction activities for the light rail alternatives, including the SR 99 North Variation and the Roosevelt Way Variation, would extend along the entire corridor. The degree to which communities would be affected by construction activities corresponds to the length of each alternative alignment—about 8.5 miles for the L1: I-5 Light Rail Alternative, 10.2 miles for the L2: SR 99 Mixed Profile Light Rail Alternative, and 10.2 miles for the L3: SR 99 Elevated Light Rail Alternative.

There is not a notable difference among alternatives in the composition of the populations residing within about 0.5 mile of the light rail alignments. All are more diverse compared to the combined two-county averages, with an estimated 35 percent minority and 8 to 10 percent low-income populations. The land use characteristics along SR 99, however, mean somewhat more residents would be affected by light rail construction associated with the L2: SR 99 Mixed Profile Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative than would be affected by the L1: I-5 Light Rail Alternative. In addition, these areas along SR 99 have already experienced extensive recent construction activity and related effects from disruption of access and business activity associated with the City of Shoreline's Aurora Corridor Improvement Program, which is expanding 60 blocks of Aurora Avenue through the city to add business access and transit (BAT) lanes, re-channelize the roadway, and upgrade the streetscape. While these construction effects could disrupt or dampen economic activity to businesses and other uses along SR 99, it would create particular hardships for low income minority populations and businesses.

5.4.2 Effects on Environmental Justice Communities

The L1: I-5 Light Rail Alternative could affect some residences through acquisitions and displacements, mostly in areas along I-5 where the WSDOT right-of-way is constrained. Few businesses would be affected. The potential displacements include areas where low-income or minority communities have been identified, but they are not concentrated in any single neighborhood.

This alternative would not create a new barrier to interaction because the alignment generally follows I-5, which already functions as a boundary for adjacent neighborhoods. The highway right-of-way is wide, sometimes at higher elevations, and has extremely limited numbers of cross streets such that interaction between residents on either side of the highway is essentially precluded. The alignment would not eliminate any existing crossings, so interaction both within and between neighborhoods would not change. Therefore, an I-5 alignment is expected to have few impacts to neighborhood cohesion of North Corridor communities.

The L2: SR 99 Mixed Profile Light Rail Alternative, which has more sections where new rights of-way would be needed, would require right-of-way acquisitions and potential displacements that are estimated be more than double the number of displacements of the L1: I-5 Light Rail Alternative. These acquisitions also would occur in areas where low-income or minority communities have been identified. The southern connection between NE Northgate Way/SR 99 would remove a portion of an existing neighborhood.

Except for the southern transition between Northgate Way and SR 99, most of the alignment follows major arterial roadways or the freeway, both of which form boundaries for adjacent neighborhoods. The existing width of the major arterial, as well as regional commercial businesses fronting the arterial with low-density residential properties behind the businesses, make interaction between residents from either side of the roadway unlikely despite frequent street crossings. Future redevelopment of transit-oriented land uses around the new transit stations, however, would create opportunities for additional interaction of residents. Light rail could alter some existing features and operations along these roadways. Several major intersections could experience higher levels of congestion, which could further discourage but not eliminate interactions between adjacent residential neighborhoods. Existing streets crossing the alignment would continue to connect neighborhoods. This alternative overall would have low adverse impacts with some benefits for community cohesion. But the east-west sections of the alignment would have a higher potential for affecting communities.

The effects of the Roosevelt Way and SR 99 North Variations would be similar to the primary L2: SR 99 Mixed Profile Light Rail Alternative, but would further increase the effects of displacements. An alignment along residential Roosevelt Way would adversely affect cohesion and interaction because this local street traverses diagonally through the middle of a residential neighborhood. The at-grade light rail operation would change vehicular, bicycle, and pedestrian mobility within the neighborhoods as well as general character with increased noise and safety concerns for children. In contrast, an alignment continuing north along SR 99 through Snohomish County would have similar effects to the other sections along SR 99,

although the east-west transition along 208th Street SW is immediately adjacent to single-family residences and nearby parks, and would have a potential for higher effects similar to the alignment along Roosevelt Way.

The L3: SR 99 Elevated Alternative would have similar impacts to the L2 SR 99 Mixed Profile Alternative, but it would remove at-grade sections and avoid the related impacts to traffic operations. It would have similar rights-of-way acquisition effects (although concentrated on the west side of SR 99 as opposed to both sides).

The cohesion of residential neighborhoods to either side of the alignment would change little considering the major arterial and the highway segments function as barriers that define the exterior boundaries of adjacent neighborhoods. However, the addition of the elevated alignment would increase the adverse barrier effect compared to the L2: SR Mixed Profile Light Rail Alternative due to changes in visual character and shadows. These changes could deter interaction between adjacent residential neighborhoods, but would cause few changes within adjacent neighborhoods. Future redevelopment of higher-density land uses, retail shops, and other transit-oriented development, however, could increase opportunities for residents of adjacent residential neighborhoods to interact near the new transit stations. The reduced traffic congestion at intersections, may somewhat improve interaction between neighborhoods on either side of the alignment corridor. As such, the effects would be similar, but somewhat more adverse, compared to the L2: Mixed Profile Light Rail Alternative.

5.4.3 Transportation Benefits

Analysis of long-term benefits to minority and low-income populations included examination of the following measures: long-term transit access benefits (residents within 0.5 mile of transit stations); improvements in travel time; and access to employment opportunities.

ACCESS TO TRANSIT STATIONS

All of the proposed transit stations would be located in minority and/or low-income communities, but the access to transit stations varies by alternative. The number of transit stations per alternative range between four and ten. The TSM/Baseline Alternative and the B2: Multi-Corridor BRT Alternative have nine and ten, respectively. The L1: I-5 Light Rail Alternative and the two light rail alternatives along SR 99 have four and five transit stations, respectively. Simply ranking the alternatives with the highest number of people within station areas reveals the following order: B2: Multi-Corridor BRT (43,000); TSM/Baseline Alternative (33,000); L2: SR 99 Mixed Profile Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative (20,000); and L1: I-5 Light Rail Alternative (13,000). While this favors the BRT alternative because it has multiple alignments and stations, it also shows that more people live near SR 99 than near I-5, in part because of the bigger area occupied by I-5.

The composition of the population near stations for the B2: Multi-Corridor BRT Alternative would be about 52 percent minority and 16 percent low-income based on 2000 census data. The composition of the station area populations for the light rail alternatives and the

TSM/Baseline Alternative are more similar, with a composition of 32 to 34 percent minority and 8 to 10 percent low income. These demographic characteristics are still more diverse than the two-county averages, indicating that the transportation and mobility benefits of any of the alternatives would be realized by low-income and minority members of the population, though the TSM/Baseline Alternative and the B2: Multi-Corridor BRT Alternative would have more stations compared to the light rail alternatives.

IMPROVED TRANSIT SERVICES

As discussed above, minority and low-income populations exist throughout the study area. Therefore, these populations can be assumed to be among the daily riders for the new transit service. The L1: I-5 Light Rail Alternative would provide the highest benefits for projected daily riders, annual new riders, and annualized hours saved. While it has a lower total population near the stations (an estimated 13,000 people), its predicted benefits indicate that it would still be likely to draw 52,000 riders daily, and provide nearly twice the annualized travel time savings of the L2: SR 99 Mixed Profile Light Rail Alternative, the next closest alternative in terms of benefits.

The L2: SR 99 Mixed Profile Light Rail Alternative would have more population near its stations (about 20,000 people), but would provide less transit benefits. Its forecasted daily ridership is 41,000, but it would have only about half the number of new annual riders and the annualized travel time savings of the L1: I-5 Light Rail Alternative.

Compared to the L2: SR 99 Mixed Profile Light Rail Alternative, the L3: SR 99 Elevated Light Rail Alternative would have similar population near its stations (about 20,000 people), and it would offer somewhat similar travel times, but with twice the frequency. Its forecast daily ridership is 48,000, which is comparable with the L1: I-5 Light Rail Alternative. This would result in transportation benefits that are in the mid-range between the L1: I-5 Light Rail and L2: SR 99 Mixed Profile Light Rail Alternatives. Considering transportation benefits as well as the proximity to low-income and minority populations, its overall benefits would be considered to be similar to the L1: I-5 Light Rail Alternative.

The B2: Multi-Corridor BRT Alternative and the TSM/Baseline Alternative have more stations and therefore would have more populations within a 0.5-mile radius, but they would offer lower transportation benefits to those populations. The TSM/Baseline Alternative is the lowest performing in this regard. The B2: Multi-Corridor BRT Alternative performs somewhat better, but still would have less than one-quarter of the daily ridership seen with the L1: I-5 Light Rail Alternative, and less than one-quarter of the annualized travel time savings.

ACCESS TO JOBS

For minority and low-income persons interested in using the proposed transit services, the average weighted travel time to the Seattle CBD is an indicator of access to employment opportunities (considering downtown Seattle is the largest employment center served by the region's transit system). Those who can most easily take advantage of these benefits are minority and low-income persons living within 0.5 mile of stations because they can most easily

walk to transit stations and would not need to transfer between travel modes or routes. The average travel time calculated for these minority and low-income populations from all stations combined to the Seattle CBD were generally the same compared to the general population, but differed by alternative. Average travel time under the TSM/Baseline Alternative was longest of all of the alternatives—about 40 minutes for all three population groups. Similarly, the average travel time under the B2: Multi-Corridor BRT Alternative was about 37 minutes for the general and minority populations, but about 1 minute shorter for the low-income population.

The average travel times to the Seattle CBD under the light rail alternatives were almost twice as fast. The average travel time for both the L2: SR 99 Mixed Profile Light Rail Alternative and the L3: SR 99 Elevated Light Rail Alternative was estimated to be 26 minutes for the general and minority populations, and about 1 minute shorter for low-income populations. With reduced headways to 4 minutes, however, overall transit services and therefore access to the Seattle CBD would be improved under the L3: SR 99 Elevated Light Rail Alternative. Average weighted travel time for all users was fastest at about 23 minutes under the L1: I-5 Light Rail Alternative, though it was about 1 minute longer for both minority and low-income populations. Therefore, when considering absolute travel times, the light rail alignment along I-5 would provide shorter travel times for both minority and low-income populations in comparison to the SR 99 alignments. However, when compared to the average weighted travel time to the Seattle CBD for the general population, minority and low-income populations would receive somewhat shorter travel times under both SR 99 light rail alternatives as compared with the L1: I-5 Light Rail Alternative.

5.5 FINANCIAL ANALYSIS

This section reports on the capital and operating cost estimates, financial feasibility, operating efficiencies, and potential risks and uncertainties associated with each alternative.

5.5.1 Key Findings

Key findings related to the financial analysis include:

CAPITAL COSTS

The TSM/Baseline Alternative is the least expensive of the alternatives.

Of the light rail alternatives, the L3: SR 99 Elevated Light Rail Alternative is the most expensive, primarily due to its longer guideway and additional station in comparison with the L1: I-5 Light Rail Alternative; and its higher vehicle fleet needs (due to shorter headways) as well as its fully elevated alignment along SR 99 in comparison with the L2: SR 99 Mixed Profile Light Rail Alternative.

OPERATING COSTS

Because of its large coverage area combined with its high frequencies of service, the B2: Multi-corridor BRT Alternative is the most expensive of all the build alternatives to operate and maintain.

Of the light rail alternatives, the L3: SR 99 Elevated Alternative has the highest operating costs due to its longer distance and running time in comparison to the L1: I-5 Light Rail Alternative; and its higher frequencies in comparison to the L2: SR 99 Mixed Profile Alternative. The operating costs of the L3: SR 99 Elevated Light Rail Alternative would be more than 30 percent higher than those for the L1: I-5 Light Rail Alternative and 40 percent higher than those for the L2: SR 99 Mixed Profile Light Rail Alternative.

The L1: I-5 Light Rail and L2: SR 99 Mixed Profile Light Rail Alternatives have similar operating costs even though the L1: I-5 Light Rail Alternative has more frequent peak period service (4 minute headways versus 8-minute headways for the L2: SR 99 Mixed Profile Light Rail Alternative) due to the longer distance and running time of the L2: SR 99 Mixed Profile Alternative.

FINANCIAL FEASIBILITY

The capital costs of the TSM/Baseline and B2: Multi-Corridor BRT Alternatives are well within Sound Transit's current financial capacity to fund. The L1: I-5 Light Rail Alternative is affordable within that capacity at the low end of its cost range, but not affordable at the high end of the range. The costs of the L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives are well outside Sound Transit's financial capacity to fund.

OPERATING EFFICIENCIES

Because of its high expected ridership, and its lower operating and capital costs, the L1: I-5 Light Rail Alternative is the most efficient of the build alternatives in terms of operating cost per passenger mile, cost per hour of user benefit, and incremental cost per new passenger.

RISKS AND UNCERTAINTIES

The three light rail alternatives have higher levels of risk and uncertainty than the bus alternatives for a variety of reasons. The rail alternatives include more infrastructure leading to higher cost amounts that could be affected by changing economic conditions; more infrastructure built across more jurisdictions resulting in higher risk associated with inter-agency coordination; and more right-of-way acquisition needs resulting in higher risk of delays.

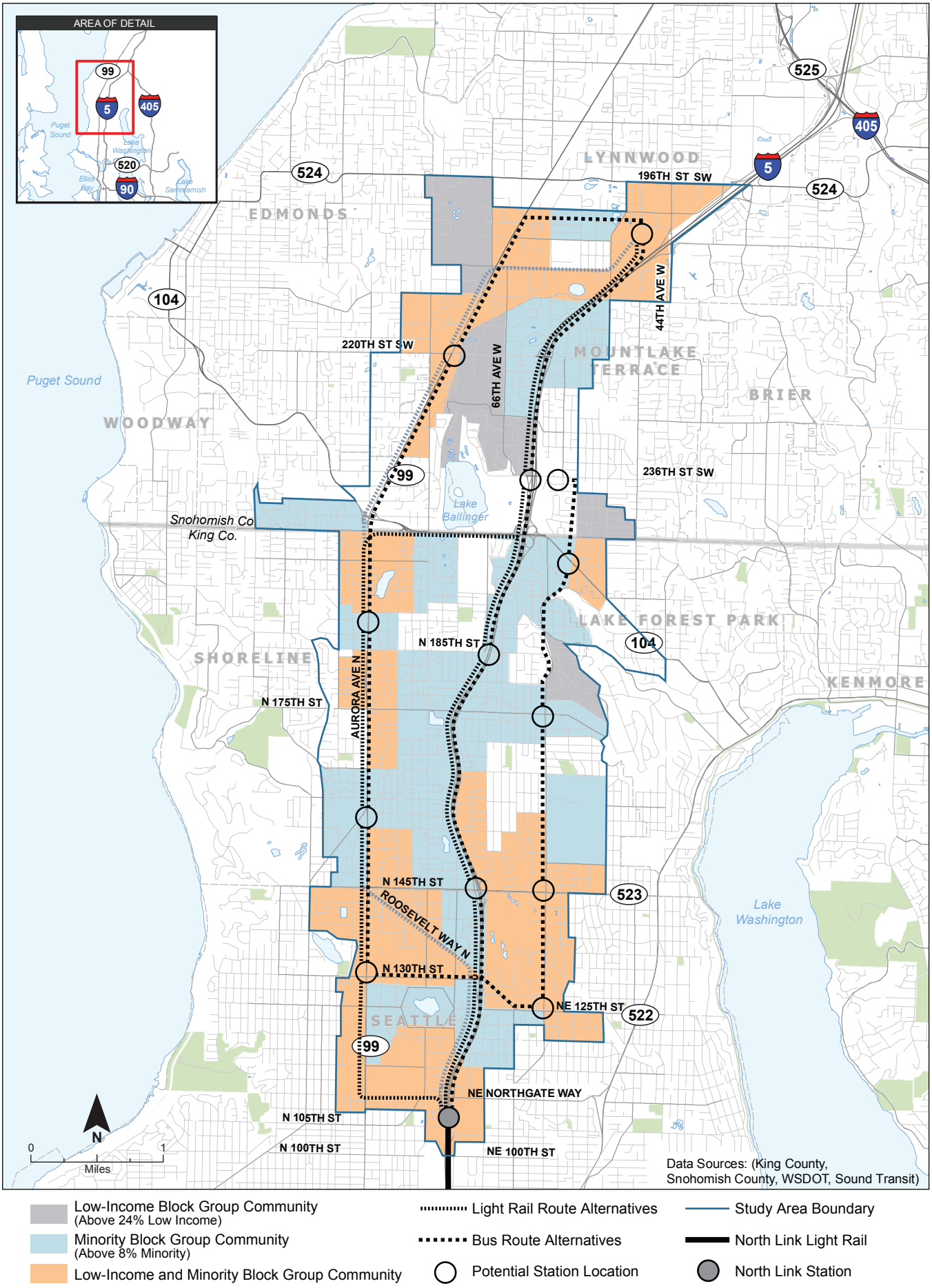


Figure 5-26. Environmental Justice Communities

5.5.2 Capital Costs

Capital costs are based on the capital cost estimating methodology documented in the Sound Transit 2 Planning Capital Cost Estimating Methodology Report (Sound Transit 2007b), which was reviewed by and endorsed by an independent Expert Review Panel, and by methods and data from the North Corridor Transit Project Level 1 Alternatives Capital and Operations Cost Estimating Methodology and Results report (Sound Transit 2011d) and the North Corridor Transit Project Unit Cost Library and Composite Section Costs report (Sound Transit 2011e).

The general approach for the Level 2 Evaluation capital cost estimating methodology consisted of four steps:

1. Define the scope of the alternatives.
2. Identify unit costs according to the methodology described herein.
3. Estimate quantities from the alternatives descriptions included in the North Corridor Transit Project: Detailed Definition of Level 2 Alternatives Technical Memorandum (Sound Transit 2011h).
4. Calculate the costs.

Costs are stated as ranges, which is appropriate for this conceptual level of design.

Significant capital cost data (Sound Transit 2008) were collected during the ST2 planning process and have been included in the Unit Cost Library for the North Corridor Transit Project. In addition to the ST2 data, available data from Sound Transit, other transit agencies, project databases, WSDOT, and other industry sources were gathered and summarized.

Cost data from other sources were considered and compared to local experience to develop the unit pricing data. Costs taken from projects in other locations were used to validate existing data and fill in the gaps for cost elements where data from Sound Transit were not available. Local historical data were not available for all project elements. In these cases, unit costs were built up based on conceptual design and cost components from other sources. Completion of the vast majority of transit improvements under Sound Move provided a wealth of cost experience for Sound Transit. In addition, Sound Transit has begun implementation of the ST2 Plan. This information relates to a variety of project stages, such as:

1. Projects that are complete or currently under construction
2. Projects that are well into final design phases and have advanced engineer's estimates
3. Projects for which preliminary engineering has been completed and anticipated costs have been reviewed and verified by independent reviews (e.g., FTA's Project Management Oversight Consultant)
4. Projects for which planning and/or environmental assessment has been completed and costs have been reviewed and verified

The cost data were reviewed and condensed to provide all-inclusive conceptual capital cost data in per route foot units, each, or using another unit basis as appropriate.

In cases where Sound Transit cost information was not available for specific project types, data were gathered from other publicly available sources, including Parsons Brinckerhoff and WSDOT (direct access ramps), as well as Community Transit and King County Metro (for *Swift* and RapidRide, respectively). Data from these other sources were refined and/or reformatted as needed to be comparable with Sound Transit's local cost data.

For cost elements where local historical cost data were not available, cost estimates were based on a conceptual scope developed as appropriate for the specific element identified (e.g., freeway BRT off-line station). These costs were developed by combining the costs of the specific material components (concrete, excavation, utility relocation, etc.) applicable to a conceptual design typical cross-section and stated in one unit cost. The typical cross-sections developed for the project were assembled on an as-needed basis if no other historical data for the system element were available.

CAPITAL COST CATEGORIES

Construction costs were calculated for the following FTA cost categories:

10. Guideway and Track Elements
20. Stations, Stops, Terminals, Intermodals
30. Yards, Shop, Administration/Support Facilities
40. Sitework and Special Conditions
50. Systems

Total construction costs are stated as the sum of categories 10 through 50.

To complete the project-wide capital cost estimate, the following FTA cost categories were also included:

60. Right-of-Way, Land, Existing Improvements
70. Vehicle
80. Soft Costs
90. Unallocated Contingency
100. Finance Charges (Note: This cost category is not included in the Level 1 evaluation capital cost estimates)

CAPITAL COST RESULTS

Table 5-28 shows cost ranges for the alternatives.

As shown in Table 5-28, the TSM/Baseline Alternative is the least expensive of the alternatives. Of the light rail alternatives the L3: SR 99 Elevated Light Rail Alternative is the most expensive. It is more expensive than the L1: I-5 Light Rail Alternative primarily due to its longer guideway and additional station. In comparison with the L2: SR 99 Mixed Profile Light Rail Alternative, the higher cost of the elevated guideway offsets the costs of reconstructing much of SR 99. However, because of its shorter headways, the L3: SR 99 Elevated Light Rail Alternative has higher vehicle fleet and maintenance facility requirements, resulting in notably higher costs than the L2: SR 99 Mixed Profile Light Rail Alternative in these categories.

Table 5-28. Capital Cost Ranges for Level 2 Alternatives

Alternative	Low (mid-2010 $million)	High (mid-2010 $million)
TSM/Baseline	$200	$230
L1: I-5 Light Rail	$1,420	$1,640
L2: SR 99 Mixed Profile Light Rail	$1,830	$2,100
SR 99 North Variation: change from primary alignment	+$140	+$160
Roosevelt Way Variation: change from primary alignment	+$30	+$35
L3: SR 99 Elevated Light Rail	$2,010	$2,310
B2: Multi-Corridor BRT	$640	$730

5.5.3 Operating Costs

LIGHT RAIL OPERATION AND MAINTENANCE COSTS

Sound Transit recently began using a new light rail O&M cost model. The new model, which is being used to test alternative North Corridor light rail scenarios, is described in Light Rail Operating and Maintenance Cost Methodology: 2011 Model for 2030 North Corridor Alternatives (Sound Transit 2011i). The report describes the background and underlying assumptions of the model, along with its structure and modules. Light rail O&M cost estimates for the light rail alternatives were provided by Sound Transit staff.

BUS OPERATIONS AND MAINTENANCE COSTS

The conceptual routing and estimated headways for the TSM/Baseline and the B2: Multi Corridor BRT Alternatives provided an estimate of bus platform hours needed for each of these alternatives. Similarly, revised routing and headway assumptions for bus service for the light rail alternatives were used to estimate the savings in bus platform hours for each of these alternatives.

The unit cost (per platform hour) for Sound Transit bus O&M varies depending on which transit partner provides the service. The current (2010) contracted hourly rate is $96 or $125 for service operated by Community Transit and King County Metro, respectively. These figures were obtained from Sound Transit for the 60-foot articulated Sound Transit coaches operated and maintained under contract by Community Transit and King County Metro.

For Sound Transit BRT service under the alternatives, 20 percent was added to the typical Sound Transit bus rates described above to cover miscellaneous additional costs such as security monitoring at BRT stations. Therefore, the estimated O&M cost would be $115 or $150 per platform hour for Sound Transit BRT service operated by Community Transit and King County Metro, respectively. The Level 2 cost estimation analysis conservatively assumes the higher rate for future service because the operator of the service is yet to be determined.

OPERATION AND MAINTENANCE COST ESTIMATES

Estimated additional (i.e., above and beyond No Build) net annual O&M costs for the Level 2 Alternatives are provided in Table 5-29. These estimates reflect savings from the truncation of parallel Sound Transit express regional bus service as well. (Note: These estimates are for the year 2030 and are expressed in 2010 dollars.)

Table 5-29. Operation and Maintenance Cost Estimates

Alternative	Annual Platform Hours Added	Annual O&M Cost (mid-2010 $million)
TSM/Baseline	141,000	$17.6
L1: I-5 Light Rail	27,000 train-hours	$11.0*
L2: SR 99 Mixed Profile Light Rail	30,000 train-hours	$10.4*
L3: SR 99 Elevated Light Rail	35,000 train-hours	$14.6*
B2: Multi-Corridor BRT	224,000	$33.6

* Light rail alternative O&M costs include savings due to ST Express regional bus service reductions.

Because of its large coverage area combined with its high frequencies of service, the B2: Multi Corridor BRT Alternative is the most expensive of all the build alternatives to operate and maintain.

The L1 and L2 light rail alternatives have similar operating costs even though the L1: I-5 Light Rail Alternative would have more frequent peak period service (4-minute headways versus 8 minute headways for the L2: SR 99 Mixed Profile Light Rail Alternative). During off peak periods when headways on both alternatives would be similar, the shorter and faster route for the L1: I-5 Light Rail Alternative would have substantially lower O&M costs compared to the L2: I-5 Mixed Profile Light Rail Alternative. The L3: SR 99 Elevated Light Rail Alternative, with its route length longer than the L1: I-5 Light Rail Alternative and more frequent headways than the L2: SR 99 Mixed Profile Light Rail Alternative (4 minutes compared with 8 minutes for the L2: SR 99 Mixed Profile Light Rail Alternative), would have higher operating costs – 30 percent higher than those

for the L1: I-5 Light Rail Alternative and 40 percent higher than the L2: SR 99 Mixed Profile Light Rail Alternative. The TSM/Baseline Alternative would have higher operating costs than any of the light rail alternatives, but is still considerably lower than the B2: Multi-Corridor BRT Alternative.

5.5.4 Financial Feasibility

This section compares the estimated capital costs of the alternatives to the lifetime capital cost funded in Sound Transit's current long-term financial plan. This comparison provides an assessment of the agency's ability to afford each alternative. Sound Transit's current financial plan funds $1,540 million in North Corridor Transit Project capital costs (Sound Transit 2011j) . Table 5-30 summarizes the capital cost of each alternative and the difference from the funded amount in financial plan.

Table 5-30. Level 2 Alternative Capital Cost Affordability

Alternative	Low Cost (mid-2010 $million)		High Cost (mid-2010 $million)	
	Estimate	Difference from Financial Plan	Estimate	Difference from Financial Plan
TSM/Baseline	$200	($1,340)	$230	($1,310)
L1: I-5 Light Rail	$1,420	($120)	$1,640	$100
L2: SR 99 Mixed Profile Light Rail	$1,830	$290	$2,100	$560
L3: SR 99 Elevated Light Rail	$2,010	$470	$2,310	$770
B2: Multi-Corridor BRT	$640	($900)	$730	($810)

The capital costs of the TSM/Baseline and B2: Multi-Corridor BRT Alternatives are well within Sound Transit's current financial capacity to fund. The L1: I-5 Light Rail Alternative is affordable within that capacity at the low end of its cost range, but not affordable at the high end of the range. The costs of the L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives are well outside Sound Transit's financial capacity to fund.

5.5.5 Operating Efficiencies

This section provides a summary of the results for the following sub-measures:

- Operating cost per passenger mile
- Cost per hour of user benefits
- Incremental cost per new passenger

Table 5-31 presents the operating cost per passenger mile for each alternative. This is calculated by dividing the annual project operating costs (less savings from bus service reductions assumed for Sound Transit, King County Metro, and Community Transit) by the estimated annual number of passenger miles traveled by users of the North Corridor Transit Project. Because of its high expected ridership, and its lower operating costs, the L1: I-5 Light Rail Alternative is the most efficient of the build alternatives in terms of operating cost per

passenger mile. The two bus-based alternatives, due to overall lower ridership and high operating costs, have considerably higher O&M costs per passenger mile than any of the light rail alternatives.

Table 5-31. 2030 Annual O&M Cost per Annual Passenger Mile

Alternative	2030 Annual O&M Cost per Annual Passenger Mile
TSM/Baseline	$0.40
L1: I-5 Light Rail	$0.06
L2: SR 99 Mixed Profile Light Rail	$0.09
L3: SR 99 Elevated Light Rail	$0.08
B2: Multi-Corridor BRT	$0.66

Note: Costs are in mid-2010 dollars and reflect savings due to Sound Transit express, King County Metro, and Community Transit bus service reductions.

Table 5-32 presents the cost per hour of user benefits for each alternative. This was calculated by dividing the sum of the annualized capital costs and annual project operating costs (less the savings from bus service reductions assumed for Sound Transit, King County Metro, and Community Transit) by the estimated annual hours of travel time saved (user benefits). Annualized capital costs were calculated using the FTA Standard Cost Categories Annualized Cost Workbook. The L1: I-5 Light Rail Alternative has the lowest cost per hour user benefits at $25 to $28 per hour, followed by the L3: SR 99 Elevated Light Rail Alternative at $42 to $48 per hour (a 72 to 75 percent increase). The L2: SR 99 Mixed Profile Alternative is slightly higher than the TSM/Baseline Alternative, though still less than the B2: Multi-Corridor BRT Alternative, which is the most expensive of all alternatives in terms of cost per user benefits.

Table 5-32. 2030 Cost per Hour of User Benefits

	2030 Cost per Hour of User Benefits	
Alternative	Low	High
TSM/Baseline	$60	$64
L1: I-5 Light Rail	$25	$28
L2: SR 99 Mixed Profile Light Rail	$61	$69
L3: SR 99 Elevated Light Rail	$42	$48
B2: Multi-Corridor BRT	$91	$99

Note: Costs are in mid-2010 dollars.

Table 5-33 presents the incremental cost per new passenger for each alternative. This measure was calculated by dividing annual operating costs and annualized capital costs by the projected annual new passengers. Similar to the cost per hour of user benefits, the L1: I-5 Light Rail Alternative has the lowest incremental cost per new passenger, followed by the L3: SR 99 Elevated Light Rail Alternative.

Table 5-33. 2030 Incremental Cost per New Passenger

	2030 Incremental Cost per New Passenger	
Alternative	**Low**	**High**
TSM/Baseline	$55	$59
L1: I-5 Light Rail	$25	$29
L2: SR 99 Mixed Profile Light Rail	$58	$67
L3: SR 99 Elevated Light Rail	$41	$46
B2: Multi-Corridor BRT	$83	$90

Note: Costs are in mid-2010 dollars.

5.5.6 Risks and Uncertainties

Previous sections of this study address the capital costs, O&M costs, and the financial resources available to fund the various alternatives. However, risks and uncertainties that could affect the successful completion of each alternative exist. During the life of the project, Sound Transit will need to identify and monitor these risks and uncertainties and take the necessary steps to control and mitigate them.

Major items of risk and uncertainty associated with the alternatives can be categorized as follows:

- Economic and financial
- Cooperation with jurisdictions, agencies, and other involved third parties
- Right-of-way acquisition and changes to current land use
- Construction

The three light rail alternatives have higher levels of risk and uncertainty than the bus alternatives for a variety of reasons. The rail alternatives include more infrastructure, leading to higher cost that could be impacted by amounts changing with economic conditions; more infrastructure would be built across more jurisdictions resulting in higher risk associated with inter-agency coordination; and more right-of-way would need to be acquired resulting in higher risk of delays.

ECONOMIC AND FINANCIAL

Economic and financial risks include such factors as the vitality of the general economy, inflation, the level of FTA funding, and maintaining control of the scopes of the projects. The vitality of the general economy can affect the program in that the primary source of local revenues, the voter-approved sales tax surcharge, can fluctuate with the health of the economy. A stronger local economy results in higher sales tax revenue. A weaker economy can result in lower than anticipated sales tax revenues available for all alternatives. However, a weaker

economy may also result in a slowing of the growth of construction costs, which could result in lower than anticipated capital costs.

Inflation, which is also an indicator of the vitality of the economy, can also affect the project. An increase in inflation beyond the current expectations would result in increased costs for all alternatives. Increased inflation would affect construction costs, O&M costs, and the cost of financing. The alternatives with the highest capital and O&M costs, namely the three light rail alternatives, would have the highest risk of all alternatives. On the other hand, sales tax revenues could also increase with higher inflation, although it is not likely to increase adequately to offset the rise in costs.

The level of FTA funding is subject to annual appropriations and future program reauthorizations. If future reauthorization legislation varies significantly from trends in the recent past as assumed in the financial analysis, projects would need to rely more heavily on local funding. Because this project will compete for New Starts funds with many other projects, the level of New Starts funds pledged to this project will not be finalized until just prior to entering into a Full Funding Grant Agreement some years from now.

All of the alternatives studied in this AA would have portions of the program constructed within the jurisdictional limits of numerous cities and two counties, and within major portions of existing WSDOT right-of-way. Each of these jurisdictions and agencies will have concerns regarding the implementation of a major transportation infrastructure within their boundaries. Any of these may request that the scope of the project elements include items that may not have been originally planned in the initial program. Sound Transit will have to monitor these issues carefully during the life of the program to maintain the scope of the various project elements.

COOPERATION WITH JURISDICTIONS, AGENCIES, AND OTHER INVOLVED THIRD PARTIES

The success of this project will depend heavily on cooperation among all parties, as previously noted. The cities, counties, and WSDOT will be responsible for issuing permits and permission to construct and operate in their rights of way. Changing requirements during the course of the project's life can result in unforeseen delays or additional costs.

RIGHT-OF-WAY ACQUISITION AND CHANGES TO CURRENT LAND USE

Right-of-way will be required for all alternatives but will be particularly critical to all three light rail alternatives at passenger station locations. Risk resulting from delays in acquiring right of-way could result in higher costs due to schedule delays.

CONSTRUCTION

The majority of construction for all alternatives will occur in existing major transportation corridors. This will create construction challenges, particularly for the light rail alternatives and bus-based alternatives that could lead to cost and schedule increases. These challenges, along with the economic risks that may affect commodity prices previously described, can add risk

and uncertainty to the project. To minimize the risk at this stage in the planning, the capital cost estimates developed for the alternatives include contingencies that vary depending on the complexity and uncertainty of the type of construction. The capital cost estimates include specific line item contingencies ranging from 15 percent to 35 percent, depending on their complexity and susceptibility to fluctuation. The capital cost estimates also include contingencies of 10 percent to account for construction change orders, which, when applied, result in overall construction contingencies of approximately 25 to 45 percent. Unallocated contingencies of 10 percent are then also included to account for unforeseen events.

5.6 CONSISTENCY WITH SOUND TRANSIT'S LONG-RANGE VISION

This measure addresses the extent to which the alternatives support the long-range vision, goals, and objectives for transit service established by Sound Transit's Long-Range Plan. This criterion was measured in three ways, as follows:

- A determination as to whether the alternative meets the definition of HCT in state law; specifically if the alternative, combined with the current HCT system, results in a system that provides a substantially higher level of passenger capacity, speed, and service frequency
- The number of miles that the alternative operates in general purpose traffic lanes
- Consistency with Sound Transit's Long-Range Plan, as measured by travel time and reliability and the capacity of an alternative to accommodate future ridership growth that may occur as a result of extending the system to Everett as envisioned in the plan

By Washington State law Sound Transit is mandated to provide a "High Capacity Transportation System" as defined by RCW 81.104.015 (2). The definition is as follows:

> *"High capacity transportation system" means a system of public transportation services within an urbanized region operating principally on exclusive rights-of-way, and the supporting services and facilities necessary to implement such a system, including interim express services and high occupancy vehicle lanes, which taken as a whole, provides a substantially higher level of passenger capacity, speed, and service frequency than traditional public transportation systems operating principally in general purpose roadways.*

The second measure was based on the "number of miles that transit operates in general purpose lanes," because it is assumed that transit traveling in general purpose lanes does not meet the definition of a HCT system. A low value—that is number of miles in general purpose lanes—means that the alternative includes a high level of consistency with the development of a HCT system, and conversely, a high value means a low level of consistency.

The third measure was based on the consistency with Sound Transit's 2005 Long-Range Plan. Both BRT and light rail are identified as transit modes in the North Corridor. The transportation system goal, as stated in Sound Transit's Regional Transit Long-Range Plan (adopted July 7, 2005) is as follows:

"Provide a public transportation system that helps ensure long-term mobility, connectivity, and convenience for the citizens of the Puget Sound region for generations to come."

Measures that relate to the ability of an alternative to meet Sound Transit's public transportation system goal overlap with other evaluation criteria as follows:

- Long-term mobility = Reliability, capacity, and travel time criteria (including the ability of the alternative to meet the long-term objective of extending regional transit to Everett)
- Connectivity and convenience = Connections to regional multi-modal system criterion (number of transfers to reach regional transit system at Northgate)

The measure for consistency with Sound Transit's Long-Range Plan is evaluated with a "yes" or "no" response. Summary findings based on evaluating the consistency of the alternatives with Sound Transit's Long-Range Plan are as follows:

- All of the light rail alternatives are consistent with the definition of a HCT system because they operate on exclusive right-of-way.
- The L1: I-5 Light Rail Alternative with 4-minute headways is consistent with light rail transit operations between Northgate and downtown Seattle and consistent with Sound Transit's Long-Range Plan.
- L2: SR 99 Mixed Profile Light Rail Alternative and both of its variations are not consistent with Sound Transit's Long Range Plan. With light rail operating at grade through a number of highly congested intersections, the headways are limited to 8 minutes. Operations with 8-minute headways do not provide the long term capacity to accommodate the demand expected from a future extension of regional transit to Everett.
- The L3: SR 99 Elevated Light Rail Alternative with 4-minute headways is consistent with light rail transit operations between Northgate and downtown Seattle and consistent with Sound Transit's Long-Range Plan.
- The TSM/Baseline and B2: Multi-Corridor BRT Alternatives are inconsistent with both the Long-Range Plan and the development of a HCT system due to bus travel in general purpose lanes, on freeways, and arterials.

Table 5-34 presents the results of the three evaluation measures. The TSM/Baseline Alternative and B2: Multi-Corridor Alternative include use of the existing I-5 HOV lanes with regional transit in both HOV lanes and general purpose lanes of I-5 as well as the SR 99 BAT lanes. The SR 99 BAT lanes include general purpose right-turning traffic at driveways and intersections. Both bus alternatives also include long segments of mixed traffic operation along substantial sections of congested arterial streets in the study corridor.

Table 5-34. Evaluation Results—Consistency with Long-Range Plan

Alternative	Definition of High- Capacity Transportation System	Miles of Operation in General Purpose Lanes[1]	Consistent with Sound Transit's Regional Transit Long-Range Plan
TSM/Baseline	No	4.9	No
L1: I-5 Light Rail	Yes	0	Yes
L2: SR 99 Mixed Profile Light Rail	Yes	0	No
SR 99 North Variation	Yes	0	No
Roosevelt Way Variation	Yes	0	No
L3: SR 99 Elevated Light Rail	Yes	0	Yes
B2: Multi-Corridor BRT	No	7.7	No

6 PUBLIC AND AGENCY INVOLVEMENT AND COORDINATION

The North Corridor Transit Project AA included extensive involvement with stakeholders, interest groups, the general public and public agencies at the local, regional, state, and federal levels. To guide this work, the project team developed involvement and coordination plans to identify constituents and partners and outline strategies for informing and involving the public. These plans were designed to be updated as the project moves forward through the project development process.

6.1 OVERVIEW OF PLANS

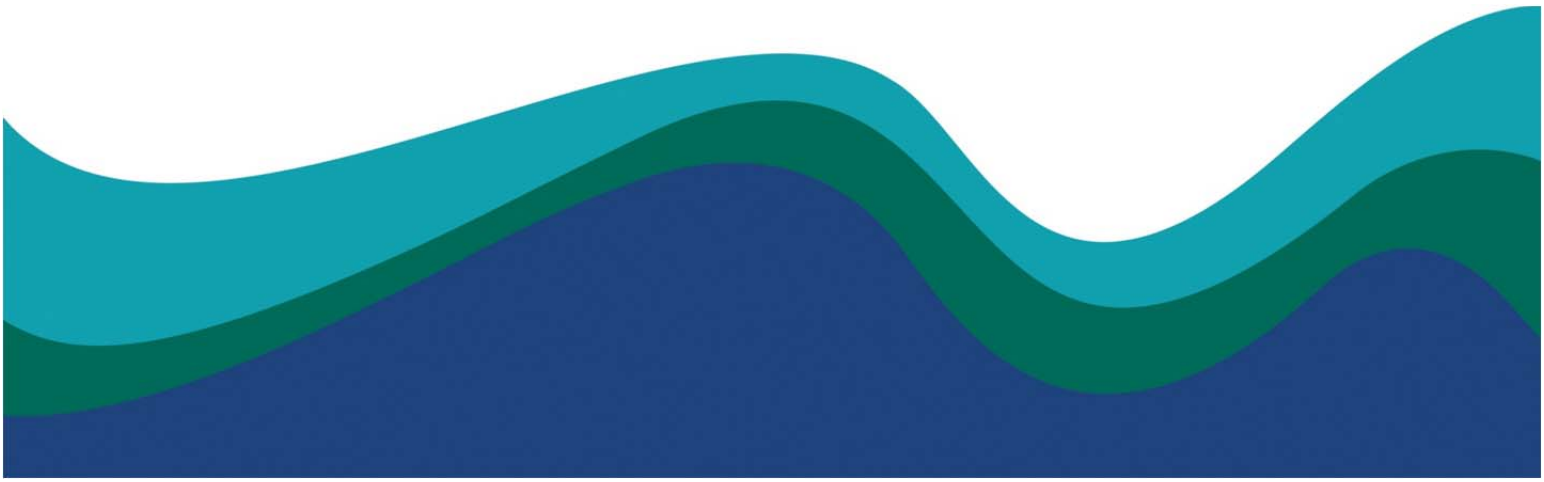
Two related agency and public involvement plans were developed to guide public involvement and agency coordination during the AA phase. The major difference between the two plans is the public involvement plan includes public involvement strategies, goals and activities for the full planning project schedule (until the final Record of Decision [ROD] is issued), while the agency coordination plan is intended to guide AA activities until the NEPA environmental process begins.

A Coordination Plan that meets federal requirements under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) has also been prepared to guide outreach and involvement activities during the environmental review phase of the project. See Chapter 8 for more discussion of this plan.

6.1.1 Public Involvement Plan

The North Corridor Transit Project Public Involvement Plan is a working, living document to be updated throughout the life of the project as it transitions through different phases. It provides a detailed blueprint for how the project is conducting its public involvement program through the following phases:

- Alternatives Analysis, Environmental Scoping, and Conceptual Engineering



- Draft Environmental Impact Statement and Early Preliminary Engineering
- Preliminary Engineering and Final Environmental Impact Statement, through Record of Decision.

After the AA/EIS/PE portion of the project, a separate plan will be developed for outreach specific to final design and construction. This project's public involvement plan is designed around the following goals for engagement in the North Corridor:

Overarching goals:

- Inform the public of the project's purpose and need, and identify and communicate the process and schedule for public participation.
- Actively seek public input throughout all project stages of planning, project development, and engineering.
- Research and respond to public inquiries, suggestions, and ideas in the decision-making process.
- Provide opportunities for the public to affect major decisions before they are finalized.
- Publicize all programs and activities through a variety of diverse communication vehicles and make the proceedings and records available for public review.
- Provide the public with different and innovative opportunities and methods for accessing project information throughout each project phase.
- Ensure diverse populations, including minority and low income populations are engaged in the planning and development process by making materials available in multiple formats, holding meetings in accessible facilities, and providing meeting and project information to underserved populations.

Project-specific goals:

- Clearly communicate the need and process for obtaining FTA New Starts grant funding.
- Communicate key project milestones and accomplishments to show progress toward project completion and the start of service. Ensure transparency of the process by communicating the needs, potential solutions, schedules, and budget information.
- Use information obtained through North Corridor stakeholder interviews and the initial public outreach effort to enhance the project team's knowledge of the area, key stakeholders, and community leaders.
- Work closely with Sound Transit government and community relations staff, and the project team to ensure public outreach efforts and government/elected official/Tribal involvement efforts are coordinated.
- Create a project record of public input, responses, and outreach activities.

- Acknowledge outreach challenges and risks, and implement outreach activities tools that help avoid them.

6.1.2 Agency Coordination Plan

An agency coordination plan was developed to guide the involvement of agencies defining the purpose and need, the problems to be solved, environmental concerns, and the range of alternatives for the North Corridor Transit Project during the alternatives analysis phase. The plan addresses coordination with the governmental entities within the project area that have statutory, regulatory, permitting, and/or funding roles: FTA, the Congressional delegation, Washington State legislators, WSDOT, PSRC, counties, cities, and transit agencies.

The purpose of the agency coordination plan is to effectively support agency participation in the scoping for the AA phase, leading to the Draft EIS.

Goals of the agency coordination plan are to:

- Ensure all agencies have similar levels of understanding surrounding proposed alternatives and associated issues.
- Clearly define and agree on Sound Transit and agency roles and responsibilities.
- Provide opportunities for agencies to provide effective feedback and review at key decision points during the AA phase.
- Encourage agencies with legally defined coordination and/or approval roles to meet all statutory and regulatory requirements to allow the project to go forward.

6.2 EARLY SCOPING

The project began with an early scoping period, which is an optional procedure under NEPA and SEPA. This was an initial step in the project's commitment to ensure open agency and public involvement in project development as expected under these Acts. The early scoping process for the North Corridor Transit Project began September 24, 2010 with a series of public notices, advertisements, and mailings, and continued through October 27, 2010.[1] Three public meetings and an agency meeting were held, and comments were accepted in a wide variety of formats. The agency meeting invited state and federal jurisdictions, as well as resource agencies.

[1] Most of the initial public notices, advertisements and mailings, including a legal notice and a SEPA Register notice, appeared on or before September 24, 2010 and requested comments by October 25, 2010. However, the official federal notice was not published in the Federal Register until September 27, 2010. To allow at least 30 days for comments, Sound Transit extended the comment period to October 27, 2010, and included the extended date on subsequent notices and on the Sound Transit Web site.

6.2.1 Public Notices in the Federal Register and the SEPA Register

Early scoping notices were published in the the SEPA Register on September 24, 2010 and in the Federal Register on September 27, 2010. With the early scoping announcements, Sound Transit and FTA invited the public and agencies to learn about the project and provide comments. The announcements provided the dates and times of public meetings, described how people could get more information about the project, and provided project contacts. They also stated the purpose of the early scoping process and described the overall planning, public involvement, and state and federal environmental processes expected for the North Corridor Transit Project. The notices invited public comments on the scope of the AA for the North Corridor Transit Project, including the purpose of the project; the range of alternatives; and the environmental, transportation, and community impacts and benefits to be considered.

To provide additional background on the project and encourage comments, Sound Transit prepared an *Early Scoping Information Report* (Sound Transit 2010f). The report provided more detail about the project corridor, the potential alternatives, and details on the public meetings and how to comment, along with a Preliminary Purpose and Need Statement and the project's current schedule. This report was available on the Sound Transit Web site effective September 24, 2010 and copies were available at the public meetings and the agency scoping meeting.

ADVERTISEMENTS AND LEGAL NOTICES

Display advertisements were placed in the following publications:

- *The Seattle Times* (legal notice, daily, 9/24/10, 10/1/10, and 10/8/10)
- *The Everett Herald* (daily, 9/29/10 and 10/5/10)
- *North Seattle Herald Outlook* (weekly, 9/29/10 and 10/6/10)
- *The Enterprise* (weekly, 9/29/10 and 10/6/10)
- *The Edmonds Beacon* (weekly, 9/30/10 and 10/7/10)
- Snohomish County Business Journal (monthly, October 2010)

Advertisements were placed in online newspapers and blogs, either continuously or based on the number of views ("impressions"). The advertisements linked directly to the project Web site.

- The Seattle Times (9/30/10 – 10/14/10)
- The Seattle PI (9/30/10 – 10/14/10)
- The Everett Herald/HeraldNet (9/30/10 – 10/14/10)
- Mountlake Terrace News (9/27/10 – 10/14/10)
- The Enterprise (9/27/10 – 0/14/10)
- The Edmonds Beacon (9/27/10 – 10/14/10)
- Snohomish County Business Journal (9/27/10 – 10/14/10)
- My Edmonds News (9/27/10 – 10/14/10)
- Lynnwood Today (9/27/10 – 10/14/10)
- Publicola (9/30/10 – 10/14/10)
- Seattle Transit Blog (9/27/10 – 10/14/10)
- Aurora Seattle (9/27/10 – 10/14/10)

FLYERS, MAILINGS, AND OTHER MEDIA NOTICES

Before the beginning of the early scoping period, postcard notices were mailed to approximately 130,000 single-family homes, apartments, and businesses in and around the North Corridor and were received beginning September 22, 2010. Bundles of postcards were distributed at nearly 35 locations in the project area. The sites included facilities serving the general public such as service or resource centers, churches, libraries, recreation centers, senior centers, and retail establishments, as well as gathering places for the Asian and Hispanic communities.

Translated information about interpretation services was provided in Spanish and traditional Chinese. These two languages were selected based on Sound Transit's translation staff recommendations and information from the most common previous translation inquiries to Sound Transit from existing vendor TeleLanguage call data. The postcards also indicated how people could receive the information in other formats or languages.

The mailing area was determined by the project team as the area in which potential alignments could be built, plus substantial additional adjacent areas that may be potential travel shed areas. This area was bounded to west by Puget Sound, the east by Lake Washington and Highway 527, the south by 103rd, and the north by North 164th Street (approximately).

Sound Transit also provided notices to local area governments, community calendars, and blogs, and they were posted on the following online sites:

- City of Shoreline
- City of Lynnwood
- City of Mountlake Terrace
- City of Lake Forest Park
- City of Edmonds
- Publicola's Publicalendar
- Shoreline Area News
- Feet First

Email notices were sent to community groups, elected officials, and city governments. A project-specific email list was developed during this phase for subsequent engagement. Notice of the project was also part of the Sound Transit "CEO Report" and highlighted on Sound Transit's home page and agency public calendar. Notification of public meetings and comment opportunities were also distributed through social media channels, using Sound Transit's Facebook page and Twitter feed.

6.2.2 Public Early Scoping

EARLY SCOPING PUBLIC MEETINGS

More than 200 people attended the public meetings, which were held at the following locations from 6:00 to 8:30 pm:

- North Seattle: October 7, 2010—Ingraham High School, 1819 North 135th Street, Seattle 98133 (40 attendees)
- Lynnwood: October 12, 2010—Lynnwood Convention Center, 3711 196th Street SW, Lynnwood 98036 (90 attendees)
- Shoreline: October 14, 2010—Shoreline Conference Center, 18560 First Avenue NE, Shoreline 98155 (80 attendees)

HOW THE PUBLIC MEETINGS WERE HELD

Each public meeting consisted of an open house, a presentation and question-and-answer period, and small group sessions that used a workshop format. All meetings were in locations accessible to persons with disabilities, and in one meeting, participants with hearing disabilities requested and were provided with sign language interpreters. The public notices and advertisements for the meetings described the format and timing of each meeting.

During the open house portion of the meetings, participants were invited to review project information, display boards, and an aerial map. Project staff was available to answer questions. A formal presentation explained Sound Transit's overall mission and services, the ST2 program, and background on the project. The presentation included a question-and-answer session, which was followed by the workshop portion of the meeting.

During the workshop, participants formed small groups, which varied from 6 to 12 people, depending on the attendance at the particular meeting. Within each group, two project staff members guided discussions, using a large aerial map of the general project corridor, encompassing areas with potential alignments identified to date, including I-5, SR 99, and 15th Avenue NE. The groups also were supplied with tools such as a scale to show a 0.5 mile and 1 mile radius around potential stations or access points, a flip chart, pens for documentation, and stick-on dots to show areas of interests.

The groups were asked the following questions to guide their conversations:

- Looking at the aerial map, where do you think there should be access to HCT service?
- Why do you think those are the right access points?
- What would make you choose differently about those access points for transit?
- How might we connect those access points?

The workshop groups had nearly 50 minutes to discuss their thoughts. They used stick-on dots to show their ideas about potential station locations and routes. Flip charts recorded major themes, including the potential features or attributes of the project. The group also provided their opinions on why some alignments or modes of transportation had more advantages or disadvantages than others. The workshop groups then shared their major points with the entire group. A summary of the workshop results is included in Section 6.3.

6.2.3 Agency Early Scoping Meeting

In addition to the Federal Register, the SEPA Register, and other legal notices, Sound Transit sent invitations for the agency scoping meeting to local, state, and federal agencies, as well as tribal governments. The agency scoping meeting was held on October 13, 2010, in the Sound Transit Board Room. Fifteen people attended the meeting, representing the following cities and agencies:

- City of Shoreline
- City of Edmonds
- City of Mountlake Terrace
- City of Everett
- City of Lynnwood
- Seattle City Light
- Snohomish County Public Works
- King County Metro
- Community Transit

6.2.4 Opportunities to Comment

Sound Transit accepted written scoping comments by U.S. mail or email through October 27, 2010 and at the public meetings.

Comments were sent to:

> Roger Iwata, North Corridor Transit Project, Sound Transit, 401 South Jackson Street, Seattle, WA 98104-2826; or roger.iwata@soundtransit.org.

The project also used an online questionnaire tool to help in targeting the online community and people who might not be able to attend a public meeting. The tool was available on the project Web site (http://www.soundtransit.org/NorthHCT) throughout the early scoping period. More information about the questionnaire tool and general results is included in Section 6.4.1.

6.3 SUMMARY OF WRITTEN COMMENTS RECEIVED

In addition to formally submitting written comments, the public also had the opportunity to express their opinions about the project by participating in the public meetings or by using the project's online questionnaire tool. Following the summary of written comments, this report summarizes the public workshop and questionnaire results. More detailed information was included in the *Early Scoping Summary Report* (Sound Transit 2010g).

The formally submitted written comments from the general public were fairly limited in number (nearly 80) as well as length, which is not uncommon for an early scoping period, when specific project alternatives are not yet defined. Nine agency comment letters were received and were typically more detailed. Agencies that submitted comments were: the cities of Edmonds, Lynnwood, Mountlake Terrace, and Shoreline, Seattle Department of Transportation, King County Department of Transportation, Snohomish County, Community Transit and the Muckleshoot Indian Tribe fisheries division. Sound Transit received comments from state and local agencies. Most of these agencies requested coordination with Sound Transit or highlighted specific concerns related to light rail construction and operation. These comments are summarized in the *Early Scoping Summary Report* (Sound Transit 2010g).

Written comments fell into five general categories, summarized below.

6.3.1 Comments Related to the Preliminary Purpose and Need Statement

Respondents who addressed what the project should achieve were in consensus with the purpose and needs stated in the Preliminary Purpose and Need Statement. Specific comments about the draft statement included:

- Connect centers with rapid and reliable high-capacity regional transit service.
- Strive for consistency with the regional transit system Long-Range Plan and its goals to eventually connect Tacoma, Seattle, and Everett.
- Consider the needs of the urban growth areas within the North Corridor and the importance of regional transit to serve the people who will live or work there.

6.3.2 Comments Specific to a Mode

Of public comments received through email, mail, phone, or at the public meetings, 33 commented on mode. Of these, 31 specified support of light rail. One respondent preferred buses and another monorail, but both of these respondents also showed support for light rail. Seven of nine agencies indicated a mode preference, and all supported light rail.

6.3.3 Comments Specific to a Potential Project Alignment or Features

Some commenters identified specific routes or stations, as follows:

- The cities of Edmonds, Lynnwood, Mountlake Terrace, Seattle, and Shoreline provided more detailed comments about specific routes or stations identified. A summary of these comments is included in the *Early Scoping Summary Report* (Sound Transit 2010g). Seattle and Shoreline recommended evaluation of only the I-5 and SR 99 corridors.
- Among individual respondents, there was the most support for light rail along I-5 followed by light rail along SR 99. There was one comment in support of light rail on 15th Avenue NE and one comment in opposition. Several respondents advocated for stops at Alderwood Mall and Lynnwood City Center, outside of the North Corridor Transit Project area. One respondent did not believe that a connection between Northgate and Lynnwood was necessary.
- Individual respondents appeared to be primarily concerned with parking, connectivity to/integration with other existing and future modes of transportation, impacts on residents in areas where stations will be constructed, and access to stations.

COMMENTS SPECIFIC TO A LOCATION OR NEIGHBORHOOD

- The City of Lynnwood asked that the analysis document the expected increase in traffic on local streets, predict the resulting increase in congestion, and recommend measures to mitigate that congestion. Lynnwood also asked that the analyses address the impact of this congestion on the planned redevelopment of the Lynnwood City Center.

COMMENTS ON ENVIRONMENTAL ISSUES OR PROCESS

- The Cities of Edmonds, Shoreline, and Lynnwood provided comments on environmental issues ranging from air pollutants and greenhouse gases to BRT emissions. King County provided comments on a range of issues. A summary of these comments is included in the *Early Scoping Summary Report* (Sound Transit 2010g).
- The Muckleshoot Indian Tribe provided information regarding the issues that should be addressed in the EIS, particularly regarding impacts on fisheries and related natural resources, including water quality and habitat.

6.4 ONLINE QUESTIONNAIRE AND ADDITIONAL PUBLIC OUTREACH

6.4.1 Online Questionnaire

Nearly 275 people completed the online questionnaire available on the project Web site (http://www.soundtransit.org/NorthHCT) throughout the early scoping period. Although the results cannot be considered a statistical representation of the public's preferences, they do provide feedback on general trends and opinions, particularly when considered in conjunction with the formal written comments and the results of the public meeting workshops. Almost half of respondents submitted additional informal written comments, narrative in nature, at the end of their entry.

Several key themes emerged from the online questionnaire tool:

- Light rail was the mode suggested by most participants. Many of these participants cited this preference because of its benefits and/or because light rail is what the public approved for the corridor in the 2008 ST2 ballot measure.
- Most people said ease of access was important. This includes strong east-west corridor connections with coordinated and direct feeder buses, substantial/appropriate parking, and easy bicycle and pedestrian access.
- Most people identified either I-5 or SR 99 as appropriate routes for the system. Several thought 15th Avenue should be considered.
- Responses about potential station areas and numbers of stations were mixed. Many people understood why the planned location of system termination is at the Lynnwood Transit Center, but many asked if it could be extended farther north to Alderwood Mall. Many people thought the new Mountlake Terrace Transit Center could provide good access to the system, whereas comments about potential southern station areas on I-5 and potential station areas on SR 99 varied.
- Overall, participants wanted to know more about the potential tradeoffs and impacts of the project. Some expressed concerns about how the project would be affected by Sound Transit's current financial situation and tradeoffs being explored by the Sound Transit Board.

Some questions were directly related to assisting the project team in planning techniques for future public engagement. Most respondents commented that their preferred method of communication and receiving information about the project was email, the Sound Transit Web site, independent Web sites, or social networking sites. Most respondents selected the following from a list of activities or places where they would be most likely to attend and receive information about the project: at a public meeting, during their commute or at a transit center, during their lunch hour, at a local place where they shop, or at a library.

6.4.2 Stakeholder Interviews

During the early stages of the AA process, Sound Transit and the consultant team conducted a series of more than 30 stakeholder interviews to learn more about the communities in the North Corridor Transit Project area, gain a better understanding of potential project challenges, and identify any audiences not previously identified.

The goals of the stakeholder interviews include:

- Develop strong relationships early on; build trust in and ultimately consensus around the decision-making process.
- Enhance the project team's knowledge of the area, key stakeholders, and community leaders.
- Develop awareness of the project and communicate the purpose and need of the project.
- Reach out to traditionally under-represented or hard-to-reach communities.

Key themes emerged from the stakeholder interviews about knowledge base, existing transit use, the project, the communities, and communications and outreach, including:

- Many recalled the Sound Transit 2 ballot measure and upon explanation understood the need to explore multiple modes of transit during the AA process.
- Most organizations expressed excitement for expanding transit north; some understood but were surprised at the length of time needed for planning and construction.
- Nearly everyone noted that better connections with existing transit service in the area are needed, particularly east/west connections.
- At most interviews, similar views to what was heard during early scoping were given, including identifying I-5 and SR 99 as potential alignments.
- Many stakeholders located in the SR 99 corridor thought that business owners were already experiencing "construction fatigue" due to Aurora revitalization projects. Many questioned the benefits of SR 99 use, given the assumed large property impacts.
- Many organizations see the value of this project and broad engagement in it; they are willing and interested in helping disseminate information through their existing channels of communication.
- This is a diverse area in terms of economic status, employment opportunities, language, culture, transit use, and accessibility. Outreach should be flexible and tailored to reach the diverse populations. Talking in person at existing gathering places is an effective way to spread information. Many people provided anecdotal language information.

- Organizations representing environmental justice populations were helpful in providing specific publications and locations where under-represented populations can be reached.

6.4.3 Public Outreach to Minority and Low-Income Populations ("Environmental Justice")

The project's public outreach efforts are being conducted to help identify and involve minority and low-income populations that could be benefited or impacted by the project. Executive Order 12898, signed by President Clinton in 1994, directs federal agencies to make achieving "Environmental Justice" part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

The project's initial analysis of the larger corridor area, using U.S. Census data and other sources, indicated that areas of the corridor contain members of a number of minority groups, including people identifying themselves as Asian or Hispanic. Based on Sound Transit's translation staff recommendations and information from the most common previous translation inquiries to Sound Transit from existing vendor TeleLanguage call data, the public notices were translated into Spanish and Chinese to help reach these groups.

Interpretation services were also offered via translated Language Line information on the postcard. When new 2010 census data are available, translation staff and consultant staff will review languages in which to translate notification information for scoping and future outreach.

In addition to the blanket mailing of 130,000 postcards with translation notices that were sent to all residential addresses in areas in and surrounding the project corridor, the project distributed bundles of postcards at nearly 35 locations in the project area. The sites included facilities serving the general public as well as specifically the Asian or Hispanic communities, such as service or resource centers, churches, libraries, recreation centers, senior centers, and retail establishments. The multiple newspaper notices in a variety of project area papers also were intended to reach low-income and minority populations in addition to others in the various communities. Information was posted in English; however, publications were selected based upon their wide range of audiences.

Sound Transit will continue to develop its strategy and outreach to environmental justice populations as the project moves forward into the environmental documentation phase and beyond. Sound Transit has made it a priority to engage and solicit input from these populations early in the planning and development process.

6.4.4 Agency Involvement

In addition to the Agency Early Scoping Meeting detailed above, Sound Transit has been working closely with agencies as outlined in the agency coordination plan. As the project

moves forward, coordination with agencies is expected to intensify and the agency coordination plan will be updated to reflect a strategy for future phases.

6.4.5 Policy Advisory Committee

Prior to Sound Transit's formal kick-off of the North Corridor Transit Project, a group of senior staff and department heads from cities, counties and transit agencies formed on their own to provide a forum for discussing policy issues related to the project among themselves as well as with Sound Transit. This group is known as the North Corridor Policy Advisory Committee (PAC). The PAC has been meeting since early 2010.

North Corridor Light Rail Policy Advisory Committee members include representatives from the following jurisdictions:

- City of Seattle
- City of Shoreline
- City of Mountlake Terrace
- City of Edmonds
- City of Lynnwood
- Snohomish County
- City of Everett
- Community Transit

6.4.6 Interagency Technical Working Group

Sound Transit formed an Interagency Technical Working Group (ITWG) of technical staff to supplement the PAC, comprised of staff that could focus more on technical aspects and have day-to-day involvement in the project. The ITWG provides an avenue for sharing technical information about the project and receiving feedback at progress and decision points. A key objective is to maintain consistency of members and participation throughout the process. The ITWG operates under the premise that this is a regional project and decisions or issues from one jurisdiction can have implications and consequences in other jurisdictions. Some members of the ITWG also represent their jurisdictions in policy-focused discussions at the PAC, and the ITWG and PAC frequently meet with Sound Transit together.

The ITWG was convened in August 2010 and it is assumed this group will continue meeting through the duration of the project.

MEMBER SELECTION PROCESS

Members were sought based on their ability to provide informed review and comment on behalf of their agency, and their technical background in transportation and/or land use and economic development. This group is not intended to provide official recommendations on policy-related decisions. Representatives from each jurisdiction/agency, listed below, also have good access to staff involved with planning, engineering, utilities, permitting, and economic development.

- City of Seattle
- City of Shoreline
- City of Edmonds
- City of Mountlake Terrace
- City of Lynnwood
- Community Transit
- WSDOT
- King County Metro
- Snohomish County
- PSRC

RESPONSIBILITIES OF INTERAGENCY TECHNICAL WORKING GROUP MEMBERS

- Attend ITWG meetings as scheduled. A minimum of 3 weeks advance notice is provided to ITWG members and each member is encouraged to appoint an alternate if the member cannot attend. Meeting topics include:
  - Purpose and need evaluation process and criteria
  - Preliminary alternatives for early scoping
  - Results of general public early scoping meetings
  - Level 1 AA evaluation results
  - Conclusion of AA evaluation
  - Identification of Draft EIS alternatives
- Act as conduit between the Sound Transit team and member agency staff, gathering information and/or disseminating information as requested by the project team.
- Review materials that will be presented to the public, scheduled with adequate review time for the Sound Transit team to produce materials.
- Provide early and informal feedback on project issues.

FORMAT OF INTERAGENCY TECHNICAL WORKING GROUP

ITWG meetings are scheduled as needed when new project information is available for review or when issues arise that need to be discussed with the group. Relevant materials are presented by the project team in an interactive workshop format. When possible, briefing materials are sent to the ITWG prior to a meeting.

Results of meetings, particularly action items, are recorded and sent to members for confirmation and follow-up. Detailed meeting minutes are not provided. During the AA, meetings were held on the following dates:

- August 19, 2010
- September 23, 2010
- October 28, 2010
- February 15, 2011
- May 10, 2011
- July 28, 2011

6.5 SHARING THE RESULTS OF THE ALTERNATIVES ANALYSIS

Sound Transit plans to provide project updates and share results of the AA with local agencies and stakeholders through the summer. Stakeholders include the general public (including minority and low-income populations), business and neighborhood organizations, special interest groups, local agencies and government officials.

Briefings will be conducted with identified key stakeholders. Over 35 potential community, transportation, and environmental organizations and over 40 government individuals, councils and committees were identified as a result of community research conducted last fall. Briefings will include a general project update, results of the AA and notification of opportunities for public comment during fall scoping.

The Sound Transit web site has a project page dedicated to the North Corridor Transit Project. This project page will be updated with the AA results and will include mechanisms for viewers to become involved in the project as it moves forward. Additionally, an electronic project update will be sent to the current Email list of over 1,000 addresses.

Eight summer fairs and festivals have been identified for Sound Transit staff to attend, to provide general agency information and specific project information at participating event booths. The events are located along the project corridor where there is strong project interest and anticipated high attendance with broad representation of the community.

A public open house is scheduled for mid-August with the purpose of sharing results of the AA. General agency and project information will also be available at this event. The location will be central to the project corridor and the planned format is an informal open house with project staff available to answer questions and provide more detailed information as the public prepares for formal scoping.

Additional meetings of the project's PAC and the ITWG will be held over the summer. Members will receive the AA results prior to public scoping.

7 COMPARATIVE EVALUATION OF ALTERNATIVES

7.1 INTRODUCTION

This chapter presents the comparative analysis of the four Level 2 build alternatives along with a discussion of the relative performance of the TSM/Baseline Alternative. The four build alternatives and a number of variations are described in detail in Chapter 4 and include the following:

- L1: I-5 Light Rail
- L2: SR 99 Mixed Profile Light Rail
- L3: SR 99 Elevated Light Rail
- B2: Multi-Corridor BRT

Chapter 4 also presents a detailed description of both the No Build and TSM/Baseline Alternatives. In addition to these alternatives, a number of other alternatives and variations were identified early in the AA process and were screened out through the initial evaluation steps as failing to satisfy the project's Purpose and Need. These alternatives, along with the reasons for dropping them, are discussed in Chapter 3.

Table 7-1 provides a summary of the Level 2 evaluation findings organized by category of the North Corridor Transit Project's Purpose and Need. The Purpose and Need, as described in Chapter 2, is summarized into six broad categories of evaluation measures that were applied to the alternatives. The six categories include those of local importance as well as FTA guidance on recommended factors to be considered in an AA. (See: Advance Notice of Proposed Rulemaking: Federal Transit Administration, 49 Code of Federal Regulations [CFR] Part 611 [Docket No. FTA-2010-0009], RIN 2132–AB02, Major Capital Investment Projects, dated June 3, 2010). The categories are:

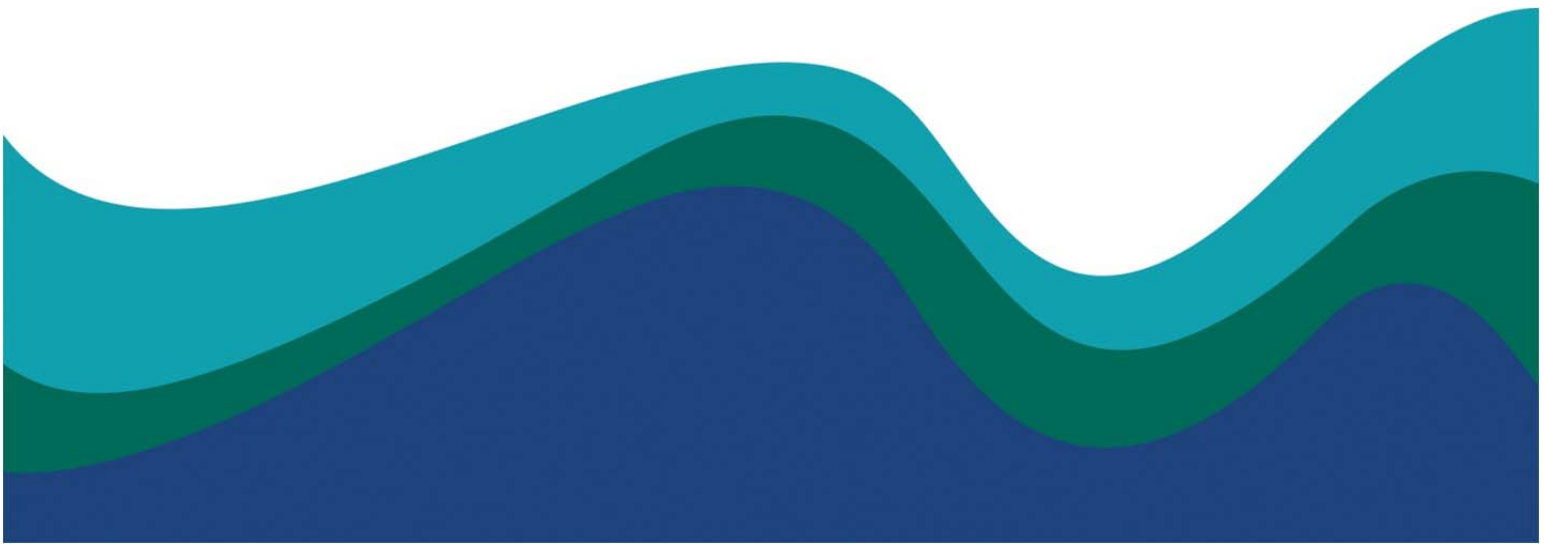


Table 7-1. Level 2 Alternatives Evaluation Summary

KEY TO RANKING

NOT CONSISTENT with Purpose and Need

LOWER PERFORMING — HIGHER PERFORMING

	TSM TSM/Baseline	**L1** I-5 Light Rail	**L2** SR 99 Mixed Profile Light Rail	**L3** SR 99 Elevated Light Rail	**B2** Multi-Corridor BRT
Purpose and Need: Transportation Effectiveness in Meeting Mobility, Access and Capacity Needs					
2030 Project Daily Riders	21,000 *Daily Riders*	52,000 *Daily Riders*	41,000 *Daily Riders*	48,000 *Daily Riders*	24,000 *Daily Riders*
2030 Annual New Riders	0.64 million *New Riders*	4.5 million *New Riders*	2.5 million *New Riders*	3.9 million *New Riders*	1.1 million *New Riders*
2030 Annual Hours of Travel Time Saved	0.59 million *Hours Saved*	4.6 million *Hours Saved*	2.4 million *Hours Saved*	3.8 million *Hours Saved*	1 million *Hours Saved*
2030 New Weekday Transit Trips to Regional Centers	1,500 *More Trips*	10,400 *More Trips*	5,300 *More Trips*	8,400 *More Trips*	2,500 *More Trips*
Capacity in passengers per hour per direction (pphpd)	1,680 *pphpd*	8,880 *pphpd*	4,440 *pphpd*	8,880 *pphpd*	3,600 *pphpd*
2030 Peak Hour Passenger Demand/Capacity	At capacity	72%	95%	62%	86%
2030 Peak Transit Travel Time: Lynnwood to Northgate	30 minutes	14 minutes	21 minutes	18 minutes	24 minutes
2030 Transit to Auto Travel Time Comparison (Peak Lynnwood to Northgate)	4 minutes *FASTER than Auto*	20 minutes *FASTER than Auto*	13 minutes *FASTER than Auto*	16 minutes *FASTER than Auto*	10 minutes *FASTER than Auto*
2030 Transit to Auto Travel Time Comparison (Peak Lynnwood to Downtown)	6 minutes *SLOWER than Auto*	10 minutes *FASTER than Auto*	3 minutes *FASTER than Auto*	6 minutes *FASTER than Auto*	Similar to Auto
Operations on Non-Exclusive Right-of-Way	23.8 miles	0 miles	0 miles	0 miles	25.8 miles
Signalized Intersections Traversed	30 *Intersections*	0 *Intersections*	5 *Intersections*	0 *Intersections*	50 *Intersections*
Number of Transfers to Reach Major Destinations	1 *Transfer*	0 *Transfers*	0 *Transfers*	0 *Transfers*	1 *Transfer*
2030 Reduction in Weekday VMT	16,900 *Fewer Miles*	191,500 *Fewer Miles*	85,200 *Fewer Miles*	160,700 *Fewer Miles*	33,100 *Fewer Miles*
Purpose and Need: Equitable Community Impacts and Benefits					
Impacts on Affected Communities	Low	Moderate	High	Moderate to High	Low
Transportation Benefits to Affected Communities	Low	High	Moderate	Moderate to High	Low
Purpose and Need: Supportive Land Use and Economic Development Effects					
Access to Regional Growth Centers	Low	High	Moderate	Moderate to High	Low
Station Areas with High TOD Potential	Not Applicable	1 *of 4 Station Areas*	2 *of 5 Station Areas*	2 *of 5 Station Areas*	2 *of 10 Station Areas*

Table 7-1. Level 2 Alternatives Evaluation Summary (continued)

KEY TO RANKING

NOT CONSISTENT with Purpose and Need

LOWER PERFORMING ← → HIGHER PERFORMING

	TSM TSM/Baseline	L1 I-5 Light Rail	L2 SR 99 Mixed Profile Light Rail	L3 SR 99 Elevated Light Rail	B2 Multi-Corridor BRT
Purpose and Need: Preservation of a Healthy Environment *At this level of concept development and analysis, measures do not account for possible impact avoidance and mitigation.*					
Ecosystem Effects	Low	Possible High Effects *on Several Sensitive Areas*	Possible High Effects *on Several Sensitive Areas*	Possible High Effects *on Several Sensitive Areas*	Possible Moderate Effects *on Several Sensitive Areas*
Water Resources Effects	Low	Moderate	Low to Moderate	Low to Moderate	Low
Potential Park or Historic Resources Effects, Including Section 4(f) Properties	Low	Low to Moderate	Low to Moderate	Low to Moderate	Low
Daily Reduction in Greenhouse Gas Emissions	Similar to No Build	235 tons	33 tons	223 tons	Similar to No Build
Visual Impacts	Low	Moderate, with Localized High	Moderate, with Localized High	Moderate, with Localized High	Low
Potential for Noise Impacts Requiring Mitigation	Low	Moderate to High	Moderate to High	Moderate to High	Low
New Transportation Right-of-Way Required	5 Acres *0 to 5 Parcels*	22 Acres *140 to 170 Parcels*	44 Acres *320 to 370 Parcels*	40 Acres *240-270 Parcels*	8 Acres *20-30 Parcels*
Traffic Impacts	Minimal	Minor Corridor-wide Improvements	Minor Degradation at SR 99 Intersections	Minimal	Minimal
Pedestrian and Bicycle Travel	Minimal	Improvements Possible Over Time Near Stations	Improvements Possible Over Time Near Stations	Improvements Possible Over Time Near Stations	Minimal
Construction Effects on Transportation System	Low Impacts	Low to Moderate Impacts over Long Duration	High Impacts over Long Duration	Moderate Impacts over Long Duration	High Localized Impacts
Purpose and Need: Cost and Constructability					
Capital Costs *(Millions of Mid-2010 Dollars)*	$200 to $230	$1,420 to $1,640	$1,830 to $2,100	$2,010 to $2,310	$640 to $730
2030 Net Annual Operations and Maintenance Costs *(Millions of Mid-2010 Dollars)*	$17.6	$11.0	$10.4	$14.6	$33.6
Cost per Hour of 2030 User Benefits *(Mid-2010 Dollars)*	$60 to $64	$25 to $28	$61 to $69	$42 to $48	$91 to $99
Incremental Cost per 2030 New Passenger *(Mid-2010 Dollars)*	$55 to $59	$25 to $29	$58 to $67	$41 to $46	$83 to $90
Purpose and Need: Consistency with Sound Transit's Long-Range Vision					
Meets State Definition of HCT	No	Yes	Yes	Yes	No
Consistent with ST Long-Range System Plan	No	Yes	No	Yes	No

- Transportation effectiveness in meeting mobility, access, and capacity needs
- Equitable community impacts and benefits
- Supportive land use and economic development effects
- Preservation of a healthy environment
- Cost and constructability
- Consistency with Sound Transit's Long-Range Plan vision

The results of the detailed Level 2 alternatives evaluation are presented in Chapter 5. Chapter 7 includes a summary discussion of the comparative performance, by category, of the four build alternatives, followed by the resulting conclusions for each alternative. Finally, Chapter 8 contains a discussion of the next steps in the New Starts project development process leading to the preparation of a Draft EIS.

The findings summary in Table 7-1 for the build alternatives shows the performance of the alternatives compared to the No Build Alternative for each performance measure. The color shadings run from dark green to light green in tones that indicate the performance of the alternatives going from best-performing to worst-performing. Red shading indicates where an alternative fails to meet the project's Purpose and Need related to that specific measure.

The TSM/Baseline Alternative is shown in grey because this alternative is developed solely for the purposes of the FTA New Starts criteria comparisons. The sections that follow provide a comparative discussion of the most significant conclusions organized by the findings in each category of the project's Purpose and Need.

7.1.1 Transportation Effectiveness in Meeting Mobility, Access, and Capacity Needs

Thirteen criteria were used to assess the transportation performance of the alternatives using 2030 as the design year. The L1: I-5 Light Rail Alternative was the best performing on 8 of the 13 criteria and equal in performance to the next best-performing L3: SR 99 Elevated Light Rail Alternative on the other 5 measures. The L2: SR 99 Mixed Profile Light Rail Alternative was substantially lower on 11 of the 13 criteria compared to the other light rail alternatives. In addition, the L2: SR 99 Mixed Profile Light Rail Alternative is forecasted to be at 95 percent of capacity in 2030, while the fully grade separated light rail alternatives have substantial capacity to carry additional riders. The B2: Multi-Corridor BRT Alternative was generally the poorest performing of the build alternatives, generally ranking last on most measures. Findings by selected key category include:

- **Annual New Riders:** This measure counts travelers who previously did not ride transit but are attracted by the project's new facilities and services. Annual new riders would be highest for the L1: I-5 Light Rail Alternative, followed closely by the L3: SR 99 Elevated Light Rail Alternative. The L2: SR 99 Mixed Profile Light Rail Alternative would

have only half the new riders of the best-performing L1: I-5 Light Rail Alternative. The B2: Multi-Corridor BRT Alternative is last with under one-quarter of the new riders of the best-performing L1: I-5 Light Rail Alternative.

- **Annual Hours of Travel Time Saved:** Travel time savings over the entire transit system as a result of the project is the key measure of user benefit assessed in the analysis. The pattern of performance of the alternatives is very similar to the performance on the new riders measure. The L1: I-5 Light Rail Alternative would save the most travel time at 4.6 million hours annually, followed closely by the L3: SR 99 Elevated Alternative at 3.8 million hours annually. Savings for the L2: SR 99 Mixed Profile Light Rail Alternative would be substantially less at 2.4 million and the B2: Multi-Corridor BRT Alternative would save the fewest hours at 1 million annually.
- **New Transit Trips to Regional Centers:** This measure looks at changes in travel to selected PSRC-designated Regional Growth Centers such as Lynnwood and downtown Seattle. The pattern of the results is very similar to the measure of new riders. The L1: I-5 Light Rail Alternative performs the best, followed by the L3: SR 99 Elevated Light Rail Alternative, the L2: SR 99 Mixed Profile Light Rail Alternative, and finally the B2: Multi-Corridor BRT Alternative.
- **Passenger Capacity:** This category was evaluated in two ways. First, the total seated and standing riders that the project could carry in a single hour in one direction was evaluated. Next, the share of total capacity that would be filled in the 2030 design year was determined. The latter measure provides information about how much growth—beyond target year ridership—the system could accommodate, and also whether the system would have room for additional riders if it were extended north to Everett, as envisioned in Sound Transit's Long-Range Plan. Both the L1: I-5 Light Rail Alternative and the L3: SR 99 Elevated Light Rail Alternative would have a capacity of 8,880 passengers per hour per direction. By 2030 it is estimated that 72 percent of L1: I-5 Light Rail Alternative's and 62 percent of the L3: SR 99 Elevated Light Rail Alternative's capacity would be required to meet peak hour demand, with the excess capacity available for continued growth in ridership in the project area, and to extend the system north to Everett. The L2: SR 99 Mixed Profile Light Rail Alternative would have half the capacity of L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative, because it would operate on 8-minute rather than 4-minute headways (the time between successive train movements in a given direction). The factors constraining L2: SR 99 Mixed Profile Light Rail Alternative headways are the five signalized intersections that would be traversed in this alternative. As a result, the L2: SR 99 Mixed Profile Light Rail Alternative would operate at 95 percent capacity in 2030 with virtually no capacity for ridership growth in the corridor or for extending the system to Everett. The B2: Multi-Corridor BRT would have substantially less capacity than the rail alternatives and be at 86 percent of capacity in 2030. The TSM/Baseline Alternative would provide even less capacity, and would be at capacity in 2030, with no

potential to handle future ridership growth or accommodate additional riders associated with extending the routes to Everett.

- **Travel Time:** The speed advantage of the L1: I-5 Light Rail Alternative is reflected in travel time differences for specific individual trips. Light rail in I-5 would cut peak-period transit travel time between Lynnwood and Northgate[1] in half, compared to the bus in the TSM/Baseline Alternative, and would be 20 minutes faster than driving. The L3: SR 99 Elevated Light Rail Alternative is the next best performer, but would be 4 minutes slower than the L1: I-5 Light Rail Alternative. This is followed by the L2: SR 99 Mixed Profile Light Rail Alternative, which would be 7 minutes slower than light rail in I-5. Finally, the bus in the B2: Multi-Corridor BRT Alternative would be 10 minutes slower than light rail in I-5. The L1: I-5 Light Rail Alternative also would be the fastest in comparison to driving from Lynnwood to downtown Seattle; it would be 10 minutes faster than the average AM peak hour automobile trip. The L3: SR 99 Elevated Light Rail Alternative is next best at 6 minutes faster than driving, while the L2: SR 99 Mixed Profile Alternative would be only 3 minutes faster, and the B2: Multi-Corridor BRT Alternative would take the same amount of time as driving.

- **Measures of Reliability:** Miles of operation on non-exclusive right-of-way and the number of at-grade signalized intersections traversed are indicators of potential sources of variable travel delays and resulting unreliable travel times. In many respects the reliability of trip times is as important to riders as actual travel times. On these measures, both the L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative would result in the most reliable travel times because both operate on fully exclusive, grade-separated guideways. The L2: SR 99 Mixed Profile Light Rail Alternative would be somewhat less reliable because it includes at-grade crossings of five signalized intersections, and the B2: Multi-Corridor BRT would be the least reliable because of the mixed traffic and HOV lane operations.

- **Impacts to Existing Transit Service:** Both the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail alternatives would replace the existing I-5 Community Transit express bus routes that connect Snohomish County to destinations in Seattle. Because of the slower rail travel times and lower capacity these bus routes would continue to operate on I-5 with the L2: SR 99 Mixed Profile Light Rail Alternative. While light rail on either the I-5 or SR 99 corridor would affect ridership on King County Metro's RapidRide BRT and Community Transit's SWIFT BRT lines operating along SR 99, the SR 99 light rail alternatives would more directly connect to and compete with those services. Metro's RapidRide E line could experience lower ridership as some riders choose instead to use light rail along SR 99, while Community Transit's SWIFT line could see increased ridership prompted by a direct connection to light rail in Shoreline not provided by light rail running along I-5. The B2: Multi-Corridor BRT Alternative would have impacts

[1] Reflects travel time to reach the regional light rail system at Northgate, which includes an added 5 minutes for non-rail modes to transfer to light rail at the Northgate Station.

on the existing bus transit services similar to the L2: SR 99 Mixed Profile Light Rail Alternative.

7.1.2 Equitable Community Impacts and Benefits

Community equity looks at potential adverse and beneficial effects on minority and low-income populations and communities, generally categorized as "environmental justice communities." Impacts include construction effects, effects on community cohesion and interaction, effects on community facilities, and displacement of residences and businesses. Benefits include long-term mobility improvements, reflecting access to stations, improvements in travel time, and access to employment.

All of the alternatives are located in an area where there are higher percentages of low-income and minority populations compared to the rest of King County or Snohomish County. Many of these communities are located in the band between SR 99 and I-5 and extend from Northgate to Lynnwood.

Impacts on affected communities for the B2: Multi-Corridor BRT Alternative are low because new facilities would be limited. Benefits are also low because the BRT alternative would attract fewer riders and provide less travel time savings than the light rail alternatives. Community impacts are moderate for the L1: I-5 Light Rail Alternative, high for the L2: SR 99 Mixed Profile Light Rail Alternative, and moderate to high for the L3: SR 99 Elevated Light Rail Alternative. The L1: I-5 Light Rail Alternative would be constructed along the freeway with fewer potential impacts on identified environmental justice communities than either of the SR 99 alternatives, which would be built in new right-of-way along a fully developed arterial highway. Community benefits would be higher for the L1: I-5 Light Rail Alternative because it would attract more riders and provides faster service, moderate to high for the L3: SR 99 Elevated Light Rail Alternative, and moderate for the L2: SR 99 Mixed Profile Light Rail Alternative.

7.1.3 Supportive Land Use and Economic Development Effects

Two key categories were used to assess land use and economic development performance: access to regional growth centers and station areas with high transit-oriented development (TOD) potential. The first measure addresses the fundamental question of how well each alternative would serve the region's adopted growth management and economic development strategies, while the second addresses TOD potential near individual stations within the project area. Key findings by these two categories include:

- **Access to Regional Growth Centers:** The North Corridor Transit Project connects two of the PSRC-designated Regional Growth Centers (Lynnwood and Northgate) to each other to help balance the regional transit system. The alternatives line up from higher to lower performing in the same order that they line up on ridership and travel time measures: the L1: I-5 Light Rail Alternative and the L3: SR 99 Elevated Light Rail Alternative perform much better than the others, followed by the L2: SR 99 Mixed Profile Light Rail Alternative and finally the B2: Multi-Corridor BRT Alternative. This

ranking and relative performance is the result of the quality, as measured by ridership and travel time, and quantity, as measured by service capacity, of transportation that would be provided.

- **Transit-Oriented Development Potential:** On TOD potential, however, the alternatives are distinguished from each other in a different order. The L2: SR 99 Mixed Profile Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative perform best on this measure because the three stations along SR 99 would provide more opportunities for TOD—where there is already a mix of supportive land uses and density—than would the two stations along I-5 in King County, which are in predominantly single-family neighborhoods. The B2: Multi-Corridor BRT Alternative also would serve the station areas along SR 99 with high TOD opportunities, but it does not rank as high as the SR 99 Light Rail Alternatives because the travel times, capacity, and reliability of the BRT service is significantly lower than for light rail. All of the alternatives would share common stations at Northgate, Mountlake Terrace, and Lynnwood.

7.1.4 Preservation of a Healthy Environment

Environmental measures focus on the range of impacts on the natural environment including water, air, endangered and protected species, and sensitive lands, as well as on the human environment including aesthetics; noise; historic and archaeological resources; property; and existing traffic, transit, pedestrian, and bicycle travel. While there are areas where environmental impacts are anticipated, none of the alternatives are expected to have impacts that would prevent an alternative from being implemented, especially considering potential avoidance and mitigation measures. At this conceptual level of development and analysis of alignments, the environmental measures do not yet reflect the potential for impact avoidance and mitigation measures that the project could incorporate through further design and environmental efforts. Despite these qualifications, there are some differences in the level of potential effects among the alternatives, including:

- **General Effects:** The light rail alternatives would construct the largest amounts of new transportation infrastructure and would require more right-of-way dedicated to transportation in the corridor. This would result in more effects on both the natural and human environments. The L2: SR 99 Mixed Profile Alternative would have the greatest effects, followed by the L3: SR 99 Elevated Light Rail Alternative, the L1: I-5 Light Rail Alternative, and then the B2: Multi-Corridor BRT Alternative.
- **Reduction in Air Pollutants and Greenhouse Gas Emissions:** Reductions in these emissions are a function of the reductions in vehicle miles traveled (VMT) and roadway congestion. While the forecasts are made at a regional level, several of the alternatives still would result in notable reductions in vehicle emissions among the alternatives, providing environmental benefits. The L1: I-5 Light Rail Alternative is forecasted to result in the largest emission reductions, followed closely by the L3: SR 99 Elevated

Light Rail Alternative. Emission reductions for the L2: SR 99 Mixed Profile Light Rail Alternative would be roughly half of those resulting from the L1: I-5 Light Rail Alternative, while the B2: Multi-Corridor BRT Alternative would be similar to the No Build Alternative.

- **Noise:** The light rail alternatives would all be near a large number of noise-sensitive properties and have the potential for noise impacts requiring mitigation. Mitigation for the L2: SR 99 Mixed Profile Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternative could be more complex, particularly for the at-grade sections of SR 99. Noise walls would be less effective given the nature of the uses fronting the arterial and the need for frequent driveway and street access. The elevated sections also have the potential to create noise impacts at greater distances. Mitigation would likely involve noise barriers along the elevated sections, which would increase the visual prominence of the guideway. For the L1: I-5 Light Rail Alternative, there are also a large number of noise-sensitive properties nearby including many single-family homes, but there are more opportunities to avoid impacts through guideway placement (for example, below the existing I-5 cut slopes) or mitigate them with noise walls. As with SR 99, the elevated guideway sections on I-5 would have the potential to cause noise impacts. Potentially affected sensitive receptors would be substantially fewer for the B2: Multi-Corridor BRT Alternative.
- **Acquisitions and Displacements:** The light rail alternatives would require continuous construction of new transportation facilities for the length of the alignment, and therefore have the greatest potential impacts. Acquisitions are greatest for the L2: SR 99 Mixed Profile Light Rail Alternative because the existing SR 99 right-of-way is nearly fully developed and adding light rail would require predominantly all new transportation right-of-way. This is followed by the L3: SR 99 Elevated Light Rail Alternative, which requires slightly less new transportation right-of-way than the L2: SR 99 Mixed Profile Light Rail Alternative because of the smaller ground footprint of the additional elevated sections. The L1: I-5 Light Rail Alternative, which would use portions of the WSDOT I-5 right-of-way, would require roughly half the new transportation right-of-way required by the L2: SR 99 Mixed Profile Light Rail Alternative. The B2: Multi-Corridor BRT Alternative would require substantially less new right-of-way in more localized areas than the light rail alternatives.
- **Transportation Effects:** In general, all of the alternatives would have beneficial effects on the existing roadway, bus transit, pedestrian, and bicycle systems. Many of these benefits are a direct result of the effectiveness of the alternatives in meeting transportation needs as discussed in Section 7.2.1. Benefits would be greatest for the L1: I-5 Light Rail Alternative, followed by the L3: SR 99 Elevated Light Rail Alternative, and then the L2: SR 99 Mixed Profile Light Rail Alternative. Benefits would be substantially fewer for the B2: Multi-Corridor BRT. On the impact side, the L2: SR 99 Mixed Profile Light Rail Alternative would degrade the performance of a number of

intersections along SR 99, while all the other alternatives would have few, if any, localized negative effects.

7.1.5 Cost and Constructability

Project affordability was evaluated based on costs, including total capital and annual O&M costs, and on cost-effectiveness measures, including the cost per unit of user benefit and cost per new rider. Key findings on these measures include:

- **Capital Costs (mid-2010 dollars):** These vary significantly among the alternatives. With a range of $2,010 to $2,310 million, the L3: SR 99 Elevated Light Rail Alternative would be the most costly to build. The L2: SR 99 Mixed Profile Light Rail Alternative is nearly as costly with an estimated range of $1,830 to $2,100. While not shown in Table 7-1, the SR 99 alignment variations are estimated to increase the capital cost of the L2: SR 99 Mixed Profile Light Rail Alternative by $30 to $35 million for the Roosevelt Way Variation and $140 to $160 million for the SR 99 North Variation in Snohomish County. Both of these variations together would raise the capital cost for the L2: SR 99 Mixed Profile Light Rail Alternative to $1,990 to $2,280 million. This is followed by the L1: I-5 Light Rail Alternative at a total capital cost of $1,420 to $1,640, which is roughly $400 to $500 million less than the range for the L2: SR 99 Mixed Profile Light Rail Alternative and $600 to $700 million less than the L3: SR 99 Elevated Light Rail Alternative. At $640 to $730 million in total, the B2: Multi-Corridor Alternative would be substantially less costly than the rail alternatives, and at $200 to $230 million the TSM/Baseline Alternative would be the least costly to build. Sound Transit's current financial plan funds $1,540 million in North Corridor Transit Project capital costs. In comparison to this, the capital costs of the TSM/Baseline and B2: Multi-Corridor BRT Alternatives are well within Sound Transit's current financial capacity to fund. The L1: I-5 Light Rail Alternative is affordable within that capacity at the low end of its cost range, but not affordable at the high end of the range. The costs of the L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives are well outside Sound Transit's financial capacity to fund.
- **2030 Net Annual O&M Costs (mid-2010 dollars):** These costs include savings in Sound Transit express regional bus services that would no longer be needed. Both King County Metro and Community Transit also are likely to see operating cost savings as a result of bus services that will no longer be needed with implementation of some of the light rail alternatives. These potential savings, however, are not included in the estimates, as they would accrue to those agencies, not Sound Transit. Overall, the rail alternatives would be less costly to operate and maintain than the bus alternatives. The L2: SR 99 Mixed Profile Light Rail Alternative would be the least costly at $10.4 million per year, followed closely by the L1: I-5 Light Rail Alternative at $11.0 million annually, and the L3: SR 99 Elevated Light Rail Alternative at $14.6 million. The TSM/Baseline Alternative would be next at $17.6 million and the B2: Multi-Corridor BRT Alternative would be the most expensive at $33.6 million annually.

- **Cost/Hour of 2030 User Benefits (mid-2010 dollars):** This is a measure of the annualized capital and year 2030 O&M costs divided by the estimated year 2030 annual hours of travel time savings. While an abstract number, the results are useful for making comparisons among alternatives to determine the relative costs of user benefits—a measure of cost effectiveness. The L1: I-5 Light Rail Alternative is by far the best performing on this measure, at roughly 60 percent of the cost per hour of user benefit of the next best-performing L3: SR 99 Elevated Light Rail Alternative. This cost measure for both the L2: SR 99 Mixed Profile Light Rail and TSM/Baseline Alternatives are over twice that for the L1: I-5 Light Rail Alternative. The B2: Multi-Corridor BRT is the least cost effective based on this measure.
- **Incremental Cost/2030 New Passenger (mid-2010 dollars):** This is another measure of cost effectiveness and calculates the annualized capital and year 2030 O&M costs divided by the year 2030 annual new transit riders. The cost per new rider calculation shows a pattern similar to the travel time savings calculations. The L1: I-5 Light Rail Alternative performs substantially better than the other alternatives, followed by the L3: SR 99 Elevated Light Rail Alternative, then the TSM/Baseline Alternative, the L2: SR 99 Mixed Profile Light Rail Alternative, and the B2: Multi-Corridor BRT Alternative in that order.

7.1.6 Consistency with Sound Transit's Long-Range Plan Vision

The final Purpose and Need category addresses whether the project is consistent with Sound Transit's Long-Range Plan, which requires it to meet the State of Washington's definition of HCT and be able to eventually extend the service north to Everett. Key findings include:

- **Consistency with State Definition of HCT:** Sound Transit's Washington State enabling legislation defines HCT as being located in exclusive rights-of-way and providing substantially higher levels of service in terms of capacity, speed, and frequency than traditional public transportation systems operating on general purpose roadways. Express buses operating in HOV lanes are recognized as an interim form of HCT service. Under this definition, only the L1: I-5 Light Rail, L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives would meet the definition of permanent HCT. Both the TSM/Baseline and B2: Multi-Corridor BRT Alternatives, while utilizing in part the I-5 HOV lanes and the SR 99 BAT lanes, would operate in large sections in general purpose traffic lanes. Thus, the B2: Multi-Corridor BRT Alternative does not meet the definition of permanent HCT.
- **Consistency with Sound Transit's Long-Range Plan:** Only the L1: I-5 Light Rail Alternative and L3: SR 99 Elevated Light Rail Alternatives are consistent with Sound Transit's Long-Range Plan for regional transit, because they are the only alternatives that provide capacity for future extensions to Everett. In addition, the L1: I-5 Light Rail Alternative would have substantially shorter travel times between Lynnwood and Northgate compared to any of the other alternatives. The L2: SR 99 Mixed Profile Light

Rail Alternative is constrained by the limitations of the at-grade segments and crossings of five major intersections, and would provide half the capacity of the L1: I-5 Light Rail Alternative. As a result, the L2: SR 99 Mixed Profile Light Rail Alternative is forecasted to be near capacity in 2030 with little capability to absorb growth or the riders added by extending the line north of Lynnwood. The B2: Multi-Corridor BRT Alternative would have some excess capacity within the project area itself by 2030, but only limited capacity to accommodate more riders from the project area, or for expansion to the north.

7.2 SUMMARY FINDINGS

The sections that follow discuss the overall findings for each build alternative. The section begins with a brief discussion of the findings regarding the TSM/Baseline Alternative, which, while not a build alternative, is the alternative that will be used as the basis for all comparisons in the FTA New Starts process.

7.2.1 TSM/Baseline Alternative

The TSM/Baseline Alternative has evolved through the AA process, beginning with an early concept of a single new express bus route to now include a comprehensive program of service changes and improvements, along with a number of low-cost transit facility, roadway, and traffic engineering enhancements. The TSM/Baseline Alternative represents the most that can be done to improve the existing regional transit system to meet the North Corridor Transit Project Purpose and Need short of major new capital investments. The analysis of the TSM/Baseline Alternative is a requirement of the FTA New Starts planning process. It will ultimately serve as the basis for the measures of cost effectiveness that will be used to judge the performance of the build alternatives and ultimately the preferred alternative later in the project development process. The alternative includes three new express bus routes connecting the project area to the light rail system at Northgate. It also includes park-and-ride supply additions and transit center enhancements to improve access to the regional transit system, along with various traffic engineering and signalization enhancements, as well as new freeway ramp and arterial bus-only lanes.

This alternative would not be very effective in meeting the principal transportation needs identified in the corridor. The TSM/Baseline Alternative would be inconsistent with both the definition of HCT and Sound Transit's Long-Range Plan vision of extending the regional transit system north to Everett. It also is the least costly and would have the fewest likely potential impacts on the surrounding environment.

7.2.2 L1: I-5 Light Rail Alternative

The L1: I-5 Light Rail Alternative has evolved from the concept originally developed as the representative light rail alignment during the ST2 system planning work. The initial alternative,

based on the ST2 concept, included a fully elevated trackway from Northgate to Lynnwood running primarily along the east side of I-5 and four new elevated stations. As a result of additional discussions with WSDOT and further concept refinements, it was determined that a significant portion of the trackway and at least one of the stations could be placed at-grade adjacent to the freeway. The at-grade sections include multiple locations along the east side of I-5 through Seattle and Shoreline and in the median of I-5 in Snohomish County. These changes have the potential to reduce the cost and impacts of this alternative as well as improve its performance.

In general, the L1: I-5 Light Rail Alternative is the best performing in terms of the transportation criteria and is the least costly of the light rail alternatives. While it has the potential for effects on the surrounding built and natural environment, the alignment along I-5 would help avoid many effects. With further planning and design, it is likely that the level of impacts can be reduced by avoidance and mitigation measures. From a land use and economic development perspective, it would do the best job of providing access to the PSRC-designated regional centers, but fall short of the L3: SR 99 Elevated Light Rail, L2: SR 99 Mixed Profile Light Rail, and B2: Multi-Corridor BRT Alternatives when it comes to serving station areas with high TOD potential. The L1: I-5 Light Rail Alternative is one of two alternatives studied in Level 2 that are capable of supporting Sound Transit's Long-Range Plan vision of extending the regional system north to Everett. From a transportation standpoint, the key findings compared to the No Build Alternative include:

- Year 2030 average weekday riders is projected to be 52,000, over twice the riders carried by the TSM/Baseline Alternative and over 4,000 daily riders more than the next best-performing alternative.
- Year 2030 total annual transit system new riders of 4.5 million and 4.6 million total annual hours of travel time savings, roughly eight times the new riders and travel time savings of the TSM/Baseline Alternative, and 15 percent more new riders and 20 percent more travel time savings than the next best-performing alternative.
- This alternative would have the capacity to carry 8,880 passengers per hour per direction, which is the same as the L3: SR 99 Elevated Light Rail Alternative, over five times the capacity of the TSM/Baseline Alternative.
- Lynnwood-to-Northgate peak-period travel times of 14 minutes would be the shortest of all the alternatives and 20 minutes faster than travel by automobile. Travel on the next best-performing L3: SR 99 Elevated Light Rail Alternative would take 4 minutes longer.
- Based on exclusive operation on a fully grade-separated guideway, the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail Alternatives would be the most reliable of all of the alternatives studied.
- In terms of impacts on regional vehicle travel statistics, the L1: I-5 Light Rail Alternative is forecasted to result in more than 10 times the reduction in VMT than the

TSM/Baseline Alternative, and slightly less than 20 percent greater VMT reductions forecasted for the next best-performing L3: SR 99 Elevated Light Rail Alternative.

The L1: I-5 Light Rail Alternative is consistent with Sound Transit's Long-Range Plan as a result of full operation on exclusive, grade-separated guideway, and conforms to the definition of HCT. In addition, extending light rail from Northgate to Lynnwood in a configuration that would allow reliable operation of trains at 4-minute peak period headways has been determined to be necessary to support eventual extension of the line north to Everett. At headways longer than 4 minutes in this segment, supplemental express bus service may be required to serve the resulting passenger demand.

Because this alternative uses substantial portions of the WSDOT I-5 right-of-way, it requires the least amount of new transportation right-of-way of the light rail alternatives, roughly half of the new transportation right-of-way needed for either of the SR 99 alternatives.

From a land use and economic development standpoint, the L1: I-5 Light Rail Alternative would do the best job of improving access to and from the two PSRC-designated Regional Growth Centers in the project area (Northgate and Lynnwood) by providing the most people-moving capacity and the shortest travel times. However, it would serve only a single station area north of Northgate (Lynnwood) that has high potential for TOD compared to two station areas (Lynnwood and North 130th Street) with high potential for the L2: SR 99 Mixed Profile Light Rail, L3: SR 99 Elevated Light Rail, and the B2: Multi-Corridor BRT Alternatives.

With a capital cost range of $1,420 to $1,640 million (mid-2010 dollars), it is the least costly of the light rail alternatives considered. From a cost-effectiveness standpoint, the L1: I-5 Light Rail Alternative is by far the best performing, with user benefit and new rider costs of 60 percent of the next best-performing L3: SR 99 Elevated Light Rail Alternative, 40 percent of those of the L2: SR 99 Mixed Profile Light Rail and TSM/Baseline Alternatives, and 30 percent of those for the B2: Multi-Corridor BRT Alternative. Based on an available budget of $1,540 million in Sound Transit's current financial plan, the L1: I-5 Light Rail Alternative is affordable at the low end of its cost range.

7.2.3 L2: SR 99 Mixed Profile Light Rail Alternative

The L2: SR 99 Mixed Profile Light Rail Alternative is a hybrid based on two earlier concepts studied during the Level 1 evaluation. It combines both at-grade and elevated alignments along portions of SR 99 through the cities of Seattle and Shoreline, then elevated on the south side of SR 104 along the county line between Shoreline and Mountlake Terrace, and then along I-5 to Lynnwood. In addition, the Level 2 alternatives evaluation process included variations using an elevated I-5 and Roosevelt Way alignment to reach SR 99 in Seattle, and a combined elevated and at-grade alignment continuing north into Snohomish County along SR 99 to 208th Street SW and then along 208th Street SW to the Lynnwood Transit Center.

As discussed in Section 4.4, early in the Level 2 alternatives development process, a major change was made to this alternative from the concept evaluated during the Level 1 alternatives

evaluation. Based on more detailed analysis of traffic and train operation through the at-grade intersections along SR 99, it was concluded that reliable operation of trains of up to four cars in length at 4-minute headways in both directions was not possible without severe impacts on cross-street and left-turn movements. The resulting traffic congestion and high potential for conflicts would increase the probability of traffic conditions that could produce train delays. Based on Sound Transit's current experience with at-grade operations, at longer headways with shorter trains on Martin Luther King Jr. Way, there is a high probability of operating delays with 4-minute headway operation at-grade on this section of SR 99. Because of the planned structure of the regional light rail network from Tacoma to Everett and across Lake Washington to Redmond, failure to maintain reliable 4-minute headways in this section would result in impacts throughout the regional system. As a result, it was determined that 8-minute headways were the most that could be achieved with partial at-grade operations and the other operating constraints of the regional light rail system.

This change would require that one of the two light rail lines serving the Northgate Station be turned back at Northgate and only one of the lines continue on to Lynnwood. This, in turn, may affect the desired configurations of the tail track and turn-back connections currently being designed at Northgate as part of Sound Transit's North Link project. It would also increase the number of transfers needed to reach some destinations served by the light rail network. In addition, as a result of the lower resulting capacity on the SR 99 link and slower speeds, it is assumed that Community Transit express bus operations from Snohomish County to downtown Seattle and the University District would continue to operate on I-5 and would not be truncated at light rail stations as in the L1: I-5 Light Rail Alternative.

With longer headways, lower capacity, and longer travel times, the L2: SR 99 Mixed Profile Light Rail Alternative does not perform as well as the L1: I-5 Light Rail Alternative or L3: SR 99 Elevated Light Rail Alternative from a transportation standpoint. The L2: SR 99 Mixed Profile Light Rail Alternative has the second highest capital costs of the alternatives studied and does not have the capacity needed for the eventual extension of light rail north to Everett. The L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives were judged to have the most proportionate beneficial land use and economic development effects around the proposed stations of all the alternatives studied in the Level 2 evaluation.

From a transportation standpoint, the key findings compared to the No Build Alternative include:

- Year 2030 average weekday riders are projected to be 41,000, the third highest of the alternatives studied and roughly 20 percent fewer than the best-performing L1: I-5 Light Rail Alternative.
- Year 2030 annual new system riders of 2.5 million and 2.4 million total annual hours of travel time savings would be realized, which is the third best-performing of the alternatives but only roughly half that of the best-performing L1: I-5 Light Rail Alternative.

- This alternative would have the capacity to carry 4,440 passengers per hour per direction, nearly three times the capacity of the TSM/Baseline Alternative but only half the capacity of the L1: I-5 Light Rail Alternative and the L3 SR 99 Elevated Light Rail Alternative.
- Lynnwood-to-Northgate morning peak-period travel times of 21 minutes would be 7 minutes longer than the L1: I-5 Light Rail Alternative but faster than travel by bus or automobile.
- Based on fully exclusive guideway operation with limited at-grade crossings, the L2: SR 99 Mixed Profile Light Rail Alternative would be more reliable than bus or automobile travel but less reliable than the L1: I-5 Light Rail Alternative or L3: SR 99 Elevated Light Rail Alternative.
- In terms of impacts on regional vehicle travel statistics, the L2: SR 99 Mixed Profile Light Rail Alternative is forecasted to result in over five times the reduction in daily VMT compared to the TSM/Baseline Alternative. However, VMT reductions are less than those forecasted for the L1: I-5 Light Rail Alternative or L3: SR 99 Elevated Light Rail Alternative.

The L2: SR 99 Mixed Profile Light Rail Alternative is consistent with the definition of HCT in the Long-Range Plan, but the 8-minute headways and resulting capacity and travel times do not support the Sound Transit's Long-Range Plan vision of eventually extending the regional system north to Everett. Based on the Level 2 ridership forecasts and 8-minute peak headways, the line to Lynnwood would operate near its practical capacity in 2030 and could not accommodate much growth or the additional riders it would attract if it were extended north to Everett.

Because this alternative involves the longest rail alignment (roughly 2 miles longer with one additional station compared to the L1: I-5 Light Rail Alternative) and the largest amount of new transportation right-of-way, it has the greatest potential for affecting the natural and constructed environment of all the alternatives.

From a land use and economic development perspective, the L2: SR 99 Mixed Profile Light Rail and L3: SR 99 Elevated Light Rail Alternatives would serve the most station areas with the highest potential for transit-oriented development of all the alternatives. However, its lower capacity and longer travel times mean that it does not perform as well as the L1: I-5 Light Rail Alternative or the L3: SR 99 Elevated Light Rail Alternative from the perspective of access between the PSRC-designated Regional Growth Centers of Northgate and Lynnwood.

With a range of $1,830 to $2,100 million (mid-2010 dollars), the L2: SR 99 Mixed Profile Light Rail Alternative is the second most costly of the alternatives considered, roughly $400 to $500 million (mid-2010 dollars) more than the L1: I-5 Light Rail Alternative. From a cost-effectiveness standpoint, the L2: SR 99 Mixed Profile Light Rail Alternative is similar to the TSM/Baseline Alternative and better than the B2: Multi-Corridor BRT Alternative, but still nearly two-and-one-half times the cost per hour of user benefit and cost per new rider compared to the best-performing L1: I-5 Light Rail Alternative. Based on an available budget of $1,540

million in Sound Transit's current financial plan, the L2: SR 99 Mixed Profile Light Rail Alternative is not within Sound Transit's financial capacity to fund.

Based on the results of the Level 2 evaluation, both the Roosevelt Way Variation and the SR 99 North Variation of the L2: SR 99 Mixed Profile Light Rail Alternative are recommended to be dropped from further consideration. In both cases, these alignment variations perform no better on most measures and on some measures worse than the base alternative when it comes to meeting the project's Purpose and Need. In addition, they are both more costly than the base alternative.

The Roosevelt Way Variation elevated alignment, while decreasing travel time by 2 minutes, would substantially alter the character and setting of what is now a low-volume arterial collector street as it passes through a neighborhood of predominantly single-family homes. In addition, this alignment would not reach SR 99 until North 145th Street, well north of the desired potential station at North 130th Street. As a result, the Roosevelt Way Variation would eliminate much of the land use and economic development advantage that the L2: SR 99 Mixed Profile Light Rail Alternative has over the L1: I-5 Light Rail Alternative. Finally, the Roosevelt Way Variation is estimated to add $30 to $35 million (mid-2010 dollars) to the cost of the base L2: SR 99 Mixed Profile Light Rail Alternative.

The SR 99 North Variation that continues the light rail line north along SR 99 into Snohomish County and then east along 208th Street SW also has several problems. It is longer than the base L2: SR 99 Mixed Profile Light Rail Alternative and would add an additional 2 minutes to the travel time between Northgate and Lynnwood. While it would provide an opportunity for a station at SR 99 and 220th Street SW, it bypasses the Mountlake Terrace Transit Center, which represents a large infrastructure investment and major node in Snohomish County's transit system. In addition, the alignment along 208th Street SW would affect the adjacent surroundings in a manner similar to that discussed for the potential impacts along Roosevelt Way. Both streets are currently low-volume residential arterials, and the introduction of light rail on a combination aerial structure and at-grade would substantially change the character and setting of the area. The SR 99 North Variation would also increase the amount of new transportation right-of-way needed. Finally, the SR 99 North Variation is estimated to increase the cost of the L2: SR 99 Mixed Profile Light Rail Alternative by $140 to $160 million (mid-2010 dollars).

7.2.4 L3: SR 99 Elevated Light Rail Alternative

The L3: SR 99 Elevated Light Rail Alternative alignment is similar to the L2: SR 99 Mixed Profile Alternative except that the at-grade running sections and two at-grade stations along SR 99 of the latter would be replaced with elevated facilities running along the west side of SR 99. These changes address the capacity and reliability problems found with the L2: Mixed Profile Light Rail Alternative and would allow operation of four car trains at 4-minute headways similar to the L1: I-5 Light Rail Alternative. In addition, this change would reduce the amount of new transportation right-of-way required and the associated potential effects on the natural and

constructed environment. On the negative side, these changes would increase construction costs with the result that the L3: SR 99 Elevated Light Rail Alternative is the most costly alternative studied, costing from $600 to $700 million (mid-2010 dollars) more than the least costly light rail alternative (L1: I-5 Light Rail Alternative).

From a transportation standpoint, the key findings compared to the No Build Alternative include:

- Year 2030 average weekday riders are projected to be 48,000, the second highest of the alternatives studied and roughly 10 percent fewer than the best-performing L1: I-5 Light Rail Alternative.
- Year 2030 annual new system riders of 3.9 million and 3.8 million total annual hours of travel time savings make this the second best performing of the alternatives and within 15 to 20 percent of the best-performing L1: I-5 Light Rail Alternative.
- This alternative has the capacity to carry 8,880 passengers per hour per direction, equal to the L1: I-5 Light Rail Alternative and twice the capacity of the L2: SR 99 Mixed Profile Light Rail Alternative.
- Lynnwood-to-Northgate morning peak-period travel times of 18 minutes would be 4 minutes slower than the L1: I-5 Light Rail Alternative but faster than travel by bus or automobile.
- Based on fully exclusive and grade-separated guideway operation, the L3: SR 99 Elevated Light Rail Alternative would be equal in reliability to the best-performing L1: I-5 Light Rail Alternative.
- In terms of impacts on regional vehicle travel statistics, the L3: SR 99 Elevated Light Rail Alternative is forecasted to result in nearly 10 times the reduction in daily VMT compared to the TSM/Baseline Alternative, but would not provide as large a reduction compared to the L1: I-5 Light Rail Alternative.

The L3: SR 99 Elevated Light Rail Alternative is consistent with Sound Transit's Long-Range Plan as a result of full operation on exclusive, grade-separated guideway, and conforms to the definition of HCT. In addition, extending light rail from Northgate to Lynnwood in a configuration that allows reliable operation of four car trains at 4-minute peak period headways would be necessary to support eventual extension of the line north to Everett. At headways longer than 4 minutes in this segment, supplemental express bus service could be required to serve the resulting passenger demand.

Because this alternative involves major infrastructure investment and construction along its entire length, it has the second greatest potential for affecting the natural and constructed environment. Overall, the levels of effects are judged to be larger than those of the L1: I-5 Light Rail Alternative. Only the L2: SR 99 Mixed Profile Light Rail Alternative, which would increase the amount of new transportation right-of-way, would have greater possible effects.

From a land use and economic development perspective, the L3: SR 99 Elevated Light Rail and L2: SR 99 Mixed Profile Light Rail Alternatives would serve the most station areas with the

highest potential for TOD of all the alternatives. However, the longer travel times of the L3: SR 99 Elevated Light Rail Alternative mean it does not perform quite as well as the L1: I-5 Light Rail Alternative from the perspective of access to the PSRC-designated Regional Growth Centers of Northgate and Lynnwood.

With a range of $2,010 to $2,310 million (mid-2010 dollars), the L3: SR 99 Elevated Light Rail Alternative is by far the most costly of the alternatives considered, roughly $200 to $500 million (mid-2010 dollars) more than the next most costly L2: SR 99 Mixed Profile Light Rail Alternative and $600 to $900 more than the L1: I-5 Light Rail Alternative. From a cost-effectiveness standpoint, the L3: SR 99 Elevated Light Rail Alternative is the second best-performing alternative, but would still be over 60 percent more costly than the best-performing L1: I-5 Light Rail Alternative. Based on an available budget of $1,540 million in Sound Transit's current financial plan, the L3: SR 99 Elevated Light Rail Alternative is well outside Sound Transit's financial capacity to fund.

7.2.5 B2: Multi-Corridor BRT Alternative

The B2: Multi-Corridor BRT Alternative consists of three BRT lines serving the project corridor between Lynnwood and the Link light rail terminus at Northgate. This alternative includes an I-5 BRT line that would connect the Lynnwood Transit Center to the Northgate Transit Center with an intermediate stop at the Mountlake Terrace Freeway Station; a line serving north Seattle and Shoreline in the SR 99 corridor that connects to I-5 at NE 130th Street; and a line serving the 15th Avenue NE corridor from Mountlake Terrace through Shoreline and north Seattle to an I-5 connection at NE 130th Street. This alternative takes greatest advantage of the BRT infrastructure that already exists in both the SR 99 and I-5 corridors and adds HOV direct access ramps between the I-5 HOV lane at NE 130th Street to and from the south, and transit-only direct access ramps at Northgate to and from the north only.

In general, this alternative's transportation performance is better than the TSM/Baseline Alternative but falls well short of the performance of the light rail alternatives, while having significantly fewer potential impacts and substantially lower capital costs than the light rail alternatives. The B2: Multi-Corridor BRT Alternative is inconsistent with both the definition of HCT and Sound Transit's Long-Range Plan vision of extending the regional transit system north to Everett.

From a transportation standpoint, the key findings compared to the No Build Alternative include:

- Year 2030 average weekday riders are projected to be 24,000, an increase of 15 percent over the TSM/Baseline Alternative, but less than half the ridership of the best-performing alternative.
- Year 2030 annual new system riders would be 1.1 million, and 1 million total annual hours of travel time savings would be realized, roughly twice the TSM/Baseline Alternative but only one-quarter to one-fifth of the best-performing alternative.

- Capacity to carry 3,600 persons per hour direction (pphd), over twice the TSM/Baseline Alternative but only 40 percent of the capacity of the best-performing alternative.
- Lynnwood-to-Northgate morning peak-period travel times of 24 minutes would be 6 minutes faster than the TSM/Baseline Alternative, 10 minutes faster than travel by auto, but 10 minutes longer than the L1: I-5 Light Rail Alternative.
- Because the B2: Multi-Corridor BRT Alternative includes significant mixed traffic operations and a transfer at Northgate to reach the balance of the region served by the light rail network, it is judged to be considerably less reliable than the light rail alternatives.
- In terms of impacts on regional vehicle travel statistics, the B2: Multi-Corridor BRT Alternative is forecasted to result in twice the reduction in daily VMT compared to the TSM/Baseline Alternative. However, VMT reductions are less than one-sixth of those forecast for the best-performing alternative.

The B2: Multi-Corridor BRT Alternative is not consistent with the definition of HCT as a result of the significant segments of mixed traffic operations of the 15th Avenue NE and SR 99 BRT lines. In addition, the use of the I-5 HOV lanes, while meeting the definition of interim HCT services, does not meet the long-range definition. The B2: Multi-Corridor BRT Alternative is also not consistent with the Long-Range Plan vision for the extension of service north of Lynnwood to Everett because it is estimated to be near capacity in the year 2030.

The B2: Multi-Corridor BRT Alternative would likely have fewer effects on the environment than any of the rail alternatives because it includes substantially less new infrastructure and transportation right-of-way, and its estimated capital costs are much lower at $640 to $730 million (mid-2010 dollars). On measures of cost effectiveness, however, the B2: Multi-Corridor BRT Alternative performs the worst of all the alternatives, with costs per hour of user benefits and cost per new rider substantially higher than any of the alternatives.

Over the course of the AA, different versions of the BRT alternative have been substantially refined and modified to address its shortcomings in meeting the project's Purpose and Need. However, even after substantial refinements through the Level 2 evaluation, the BRT alternative continued to perform poorly in three critical areas of the Purpose and Need: transportation effectiveness, cost and constructability (cost-effectiveness), and consistency with Sound Transit's Long-Range Plan vision. From a transportation effectiveness standpoint, the B2: Multi-Corridor BRT Alternative falls well short of the performance of the rail alternatives on every performance measure and is only marginally better than the TSM/Baseline Alternative on many. The weak transportation benefits combined with large capital and O&M costs result in very unfavorable cost-effectiveness performance for the B2: Multi-Corridor Alternative, falling well short of the performance of the TSM/Baseline Alternative on all three performance measures. Finally, the B2: Multi-Corridor BRT Alternative would not have sufficient capacity to support the long-range plan goal of extension north to Everett.

8 CONCLUSIONS AND NEXT STEPS

Based on the results of the North Corridor Transit Project AA, Sound Transit plans to move forward with the next steps in the development of a major capital investment in the North Corridor connecting Northgate to Lynnwood. This chapter summarizes the conclusions of the AA and provides an overview of the next steps in the New Starts project development process, including satisfying the requirements for environmental review under NEPA and SEPA.

Following both federal and local review of the findings and conclusions of the AA, Sound Transit plans to identify those alternatives to carry forward for further development and study in the NEPA and SEPA environmental process, including the possible identification of a Locally Preferred Alternative (LPA).

8.1 CONCLUSIONS AND TRADE-OFFS AMONG THE ALTERNATIVES

Figure 8-1 summarizes the entire AA alternatives screening and evaluation process. The AA process started with the identification of both bus and light rail concepts and numerous alignment and corridor variations, progressed through both a pre-screening and concept screening step, and then moved through two levels of detailed evaluation. The AA process initially identified three primary light rail alternatives (one along 15th Avenue NE, one focused on I-5, and one along SR 99) and two BRT alternatives. Through the initial screening and Level 1 evaluation process, these alternatives were refined to four (one I-5 light rail concept, two SR 99 light rail concepts, and a multi-corridor BRT concept) that showed the greatest promise for meeting Purpose and Need and were studied in greater detail as part of the Level 2 evaluation. This work resulted in the following primary conclusions regarding the performance and trade-offs among these four alternatives:

- Light rail transit is the only mode that would satisfy the North Corridor Transit Project's Purpose and Need related to transportation effectiveness in meeting the corridor's mobility, access, and capacity needs; as well as Purpose and Need related to consistency with Sound Transit's Long-Range Plan vision.

- Fully grade-separated light rail alternatives markedly outperform alternatives that include at-grade crossings in satisfying Purpose and Need related to transportation effectiveness in meeting the corridor's mobility, access, and capacity needs. Moreover, fully grade-separated light rail alternatives are the only alternatives that would meet Purpose and Need related to consistency with Sound Transit's Long-Range Plan vision.
- The fully grade-separated alignments of the L1: I-5 Light Rail and L3: SR 99 Elevated Light Rail alternatives provide the best balance of transportation benefits while accomplishing other elements of the North Corridor Transit Project's Purpose and Need. These elements include community equity, supportive land use and economic development effects, and consistency with Sound Transit's Long-Range Plan vision.
- The transportation performance of the L1: I-5 Light Rail Alternative is superior or equal to the L3: SR 99 Elevated Light Rail Alternative on all measures. In addition, the L1: I-5 Light Rail Alternative would be substantially less costly than the L3: SR 99 Elevated Light Rail Alternative. As a result, the L1: I-5 Light Rail Alternative's cost effectiveness is substantially better than the L3: SR 99 Elevated Light Rail Alternative on measures related to the cost per new rider and cost per unit of user benefit.
- Given the $1,540 million (mid-2010 dollars) currently budgeted for the North Corridor Transit Project capital costs in Sound Transit's current financial plan, the SR 99 light rail alternatives (L2 and L3) would both be well outside of Sound Transit's existing financial capacity to fund. The L1: I-5 Light Rail Alternative, however, is affordable within that capacity at the low end of its capital cost range.
- The L1: I-5 Light Rail Alternative results in the shortest travel times and greatest access improvements to Northgate and Lynnwood, the primary regional centers designated by Vision 2040 to accommodate future growth within the North Corridor. The L3: SR 99 Elevated Light Rail Alternative would have greater economic development and TOD potential in the intermediate station areas in the cities of Seattle and Shoreline than would the L1: I-5 Light Rail Alternative.
- The L1: I-5 Light Rail Alternative takes advantage of substantial portions of the existing WSDOT I-5 right-of-way that are not needed for current or future roadway, while the SR 99 alternatives would require new rights-of-way. The use of the I-5 right-of-way reduces the likely level of potential effects on the environment compared to the L3: SR 99 Elevated Light Rail Alternative, which requires almost twice the amount of new transportation right-of-way.

Based on the conclusions of the Level 2 evaluation, the TSM/Baseline Alternative should move forward in its current form as the basis for the FTA New Starts comparisons, but it would not be a build alternative within the EIS because it would not achieve the project's purpose and need.

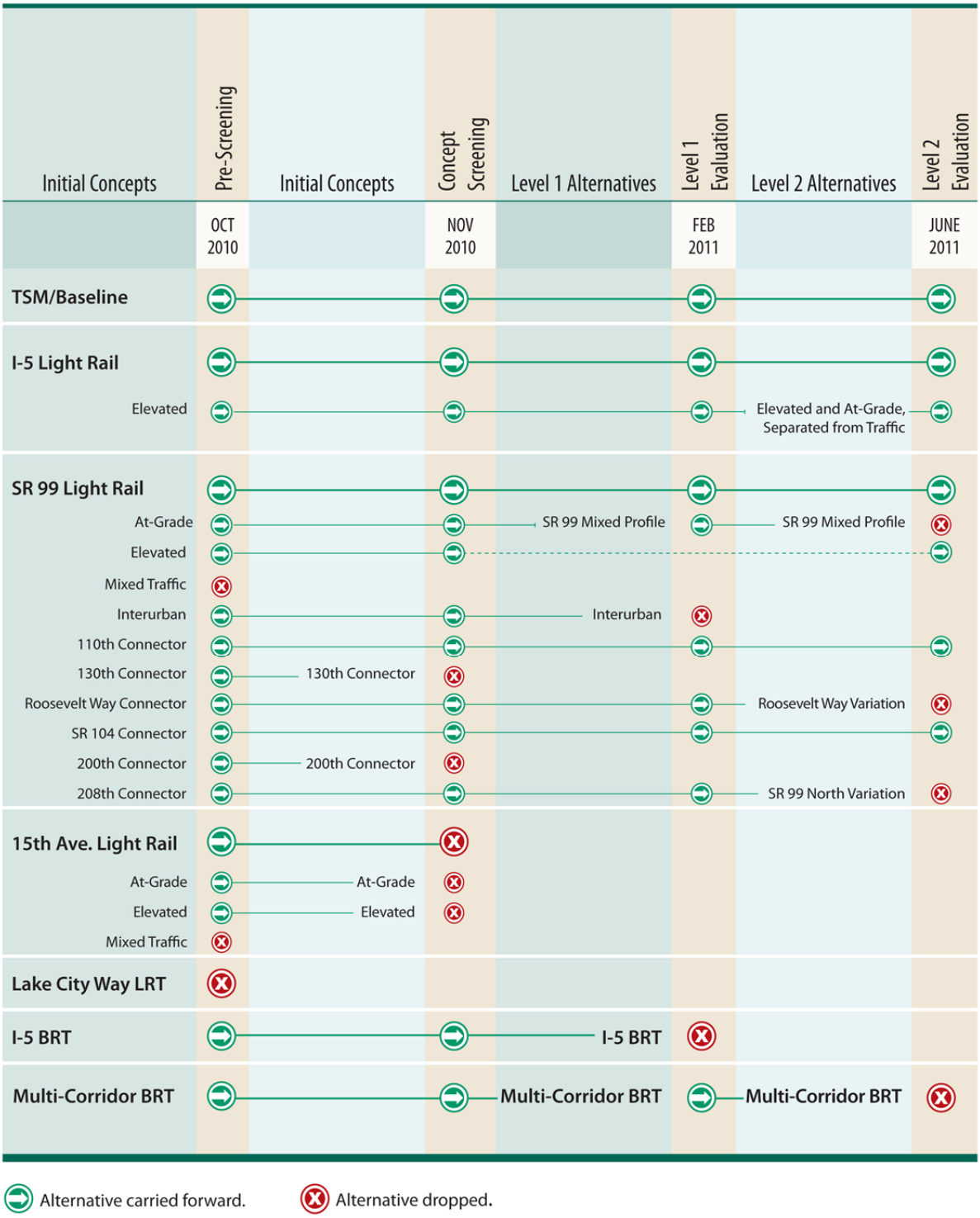


Figure 8-1. Summary of Alternatives Development, Screening, and Evaluation Process

8.2 ENVIRONMENTAL PROCESS AND SAFETEA-LU REQUIREMENTS

Sound Transit will conduct further scoping and subsequent environmental review for the North Corridor Transit Project in accordance with NEPA and SEPA regulations. Based on the scope of the proposed action and the potential environmental effects information developed through the AA, Sound Transit and FTA will prepare an EIS.

The EIS process will begin with environmental scoping under NEPA and SEPA involving the public, agencies, and tribes. Following scoping and a decision by the Sound Transit Board concerning the alternatives to be studied further in the EIS and the potential identification of a Locally Preferred Alternative (LPA), Sound Transit will move ahead with the preparation of a Draft EIS and conduct conceptual design, environmental analysis, public involvement, and agency coordination. The EIS process will continue through issuance of the Draft EIS for public and agency review and comment, preparation of a Final EIS, and conclude the NEPA process with a Record of Decision (ROD) by FTA. More information about the EIS process is provided in the North Corridor Transit Project *Environmental Scoping Information Report*, which is available on the project Web site.

FTA's regulations implementing NEPA, as well as provisions enacted through the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), emphasize the importance of public involvement in the EIS process. SAFETEA-LU provides additional direction on how agencies and tribes are to be involved. Section 6002 of SAFETEA-LU requires that this agency: "(1) Extend an invitation to other Federal and non-Federal agencies and Indian tribes that may have an interest in the proposed project to become "cooperating" or "participating agencies," (2) provide an opportunity for involvement by agencies and the public in helping to define the purpose and need for a proposed project, as well as the range of alternatives for consideration in the impact statement, and (3) establish a plan for coordinating public and agency participation in and comment on the environmental review process." Sound Transit and the FTA have prepared a Coordination Plan (available on the project website) to guide their efforts for coordinating the participation of the public, agencies, and tribes in the environmental review of the North Corridor Transit Project.

8.3 NEXT STEPS

Based on the results of the North Corridor Transit Project AA, Sound Transit plans to move forward in developing a major transit capital investment in the corridor between Northgate and Lynnwood. The next step is to share the findings of the AA with the public and elicit agency and public feedback through formal environmental scoping.

Sound Transit and FTA will initiate scoping for the EIS with a 30-day public comment period that will include several public meetings and one agency meeting. In accordance with SAFETEA-LU Section 6002, Sound Transit and FTA will invite agencies and tribes to be involved as cooperating or participating agencies, including WSDOT; Federal Highway Administration; the

cities of Seattle, Shoreline, Mountlake Terrace, Edmonds, and Lynnwood; Snohomish and King counties (including King County Metro Transit); Community Transit; tribes; and other local, regional, state, and federal agencies.

The EIS scoping process provides an opportunity for public comments on the Purpose and Need for the project, the proposed alternatives to be considered, and environmental issues to be evaluated in the EIS. This AA report was prepared to provide further details about the alternatives that have been considered. The report, which will be an important part of the environmental record for the project, describes how alternatives were developed leading to the EIS. It also describes how their anticipated performance was used to identify the most promising alternatives, and it explains why other alternatives have been removed from consideration.

Following scoping, Sound Transit will prepare and release a scoping summary report. The scoping summary report will document the comments Sound Transit has received about the Purpose and Need, alternatives, and environmental issues. The public and agency comments received during scoping will help Sound Transit, at the direction of the Sound Transit Board, to confirm the Purpose and Need for the project, identify the issues and alternatives to be considered in the Draft EIS, and potentially identify an LPA. The comments will also be considered as Sound Transit, FTA, and other participating and cooperating agencies define the scope of the EIS and its related technical analysis, including any special issues to be addressed.

Work on the Draft EIS will start early in 2012 and take from 12 to 18 months to complete. The No Build Alternative will be carried forward to provide the basis for comparison of the impacts and benefits of the build alternative(s). The TSM/Baseline Alternative, however, will move forward in its current form only as the basis for the FTA New Starts comparisons, but not as a build alternative. If Sound Transit does not identify an LPA prior to the start of the DEIS, then multiple build alternatives will be developed further and studied as part of the DEIS, with identification of the LPA occurring after the DEIS is issued. Following public review of the DEIS, Sound Transit will complete preliminary engineering for the LPA and develop a Final EIS. Based on the Final EIS, the Sound Transit Board will select the project to be built and operated. FTA will issue a Record of Decision (ROD) and the project will then move into the final design, construction, start-up and testing, and ultimately operation. Service is planned to begin in 2023.

9 REFERENCES

Community Transit. 2010. 2007–2009 Load vs. Seat Capacity Analysis. Everett, Washington.

PSRC (Puget Sound Regional Council). 2004. High Capacity Transit Corridor Assessment. Seattle, Washington.

PSRC (Puget Sound Regional Council). 2005. Regional Economic Strategy for the Central Puget Sound Region. Adopted September 27, 2005. Available online at: http://www.prosperitypartnership.org/strategy/index.htm.

PSRC (Puget Sound Regional Council). 2008. Population and Housing Estimates. Available online at: <http://www.psrc.org/data/pophousing/pophousing-estimates>.

PSRC (Puget Sound Regional Council). 2009. VISION 2040: The Growth Management, Environmental, Economic, and Transportation Strategy for the Central Puget Sound Region. Available online at: <http://psrc.org/growth/vision2040/pub/vision2040-document/>.

PSRC (Puget Sound Regional Council). 2010a. Transportation 2040—Toward a Sustainable Transportation System. Available online at: http://psrc.org/assets/4847/348transportation2040final.pdf. May 20, 2010.

PSRC (Puget Sound Regional Council). 2010b. Transportation 2040: Final Environmental Impact Statement. Available online at: http://psrc.org/transportation/t2040/t2040-pubs/transportation-2040-final-environmental-impact-statement. March 19, 2010.

Sound Transit (Central Puget Sound Regional Transit Authority). 1996. Sound Move—The Ten-Year Regional Transit System Plan. Everett, Washington. May 1996.

Sound Transit (Central Puget Sound Regional Transit Authority). 2005a. Regional Transit Long-Range Plan. Available online at: <http://www.soundtransit.org/x2397.xml>. Adopted July 7, 2005.

Sound Transit (Central Puget Sound Regional Transit Authority). 2005b. Regional Transit Long-Range Plan Supplemental Final Environmental Impact Statement. Available online at: <http://www.soundtransit.org/x2399.xml?t3xt>. June 2005.

Sound Transit (Central Puget Sound Regional Transit Authority). 2007a. ST2 Plan. Adopted May 24, 2007.

Sound Transit (Central Puget Sound Regional Transit Authority). 2007b. Sound Transit 2 Planning Capital Cost Estimating Methodology. Prepared by Parsons Brinckerhoff, Seattle, Washington. March 2007.

Sound Transit (Central Puget Sound Regional Transit Authority). 2008. Sound Transit 2 HCT Prototypical Alignment Cost Estimating: Unit Cost Library and Composite Section Costs. Prepared by Parsons Brinckerhoff, Seattle, Washington. February 2008.

Sound Transit (Central Puget Sound Regional Transit Authority). 2009. Link Light Rail North Link Design Criteria Manual. Prepared by North Corridor Transit Partners, Seattle, Washington. May 2009.

Sound Transit (Central Puget Sound Regional Transit Authority). 2010a. Draft Design Year 2030 Ridership Forecasts. Prepared by North Corridor Transit Partners, Seattle, Washington.

Sound Transit (Central Puget Sound Regional Transit Authority). 2010b. Project Context and Baseline Conditions Technical Memorandum. Prepared by North Corridor Transit Partners, Seattle, Washington. September 2010.

Sound Transit (Central Puget Sound Regional Transit Authority). 2010c. Previous Studies and Findings Technical Memorandum. Prepared by North Corridor Transit Partners, Seattle, Washington. July 2010.

Sound Transit (Central Puget Sound Regional Transit Authority). 2010d. Level 1 Alternatives Ridership Forecasts. Prepared by North Corridor Transit Partners, Seattle, Washington. January 2010.

Sound Transit (Central Puget Sound Regional Transit Authority). 2010e. Transit Ridership Forecasting Technical Report. Prepared by North Corridor Transit Partners, Seattle, Washington. December 2010.

Sound Transit (Central Puget Sound Regional Transit Authority). 2010f. Early Scoping Information Report. North Corridor High Capacity Transit Project. Seattle, Washington. September 2010.

Sound Transit (Central Puget Sound Regional Transit Authority). 2010g. Early Scoping Summary Report. North Corridor High Capacity Transit Project. Seattle, Washington. December 2010.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011a. Level 1 Alternatives Analysis and Evaluation Report. Prepared by North Corridor Transit Partners, Washington. February 2011.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011b. Alternatives Evaluation Framework, Criteria, and Methodologies Technical Memorandum. Prepared by North Corridor Transit Partners, Seattle, Washington. January 2011.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011c. Level 1 Definition of Alternatives Technical Memorandum. Prepared by North Corridor Transit Partners, Washington. January 2011.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011d. North Corridor Transit Project Level 1 Alternatives Capital and Operations Cost Estimating Methodology and Results. Prepared by North Corridor Transit Partners, Seattle, Washington. January 2011.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011e. North Corridor Transit Project Unit Cost Library and Composite Section Costs. Prepared by North Corridor Transit Partners, Seattle, Washington. January 2011.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011f. Level 2 Definition of Alternatives Technical Memorandum. Prepared by North Corridor Transit Partners, Seattle, Washington. March 2011.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011g. Station Area Development Potential Technical Memorandum. Prepared By North Corridor Transit Partners, Seattle, Washington. July 2011.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011h. North Corridor Transit Project: Detailed Definition of Level 2 Alternatives Technical Memorandum. Prepared by North Corridor Transit Partners, Seattle, Washington.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011i. Light Rail Operating and Maintenance Cost Methodology: 2011 Model for 2030 North Corridor Alternatives. Prepared by Sound Transit, Seattle, Washington. February 2011.

Sound Transit (Central Puget Sound Regional Transit Authority). 2011j. 2011 Transit Improvement Plan: Appendix A—ST2 Capital Estimates. December 2010.

U.S. Census Bureau. 2000. United States Census 2000 Data. Available online at: http://www.census.gov/main/www/cen2000.html.

WSDOT (Washington State Department of Transportation). 2009. The 2009 Congestion Report: WSDOT's Comprehensive Analysis of System Performance on State Highways, November 2009. Released by Paula J. Hammond, P.E., Secretary of Transportation, Olympia, Washington.